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DIVISION OF FISH AND GAME
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THE RIGHTS OF THE AMATEUR SPORTSMAN

By Walter R. Welch

Without favoritism, mankind was originally given dominion over all game. There is biblical authority for the assertion that originally man was given dominion over the fowl of the air, the fish of the sea, and the wild beasts of the fields, with authority to subject all such animals to his use, comfort or pleasure. For a comparatively brief period thereafter he, apparently in common with others of the race, exercised without let or hindrance the right thus conferred, and made use of the wild beasts, birds and fish for food and raiment, so far as the nature and character of the animals permitted.

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Animals *ferae naturae,* however, like all other species of property of any value, whether tangible or intangible, were soon lost to the generalty of mankind, and all rights therein early vested in various rulers of the race and such favored citizens as, at the pleasure of the ruler, were granted the right to hunt and possess different kinds of game on conditions which the sovereign power saw fit to impose.

In England this right was asserted by her rulers, until by *magna charta* and forest charter this assumption of property rights in animals *ferae naturae* was surrendered by the sovereign to the general public, with the exception of the right to control and regulate the taking of game for the purpose of preserving it for the benefit of the public at large, which is still retained by the sovereign power.

In this country it is well settled that all animals *ferae naturae* belong to the states as trustees for the public, and that it is not only the right, but the duty of the state as such trustee so to regulate and control the taking of game and fish as to preserve them from wanton waste and destruction.

The ordinary individual who is not the fortunate possessor of land on which there is to be found wild game, by a somewhat violent yet conclusive presumption of law, is presumed to know that this is a species of property of which, as a citizen of this land of the free, he is possessed equally with the other citizens. This great heritage, he is informed, is the reason for the enactment and enforcement of the game laws, which, although in many respects seriously entrenching upon other property rights, he cheerfully acquiesces in, since thereby his property right in wild game is preserved.

Owing to the nature of wild game this right, at the most, may be a very intangible one, and yet to many citizens it is undoubtedly more real than other property rights. Of course this property right vests equally in the resident of the city or town, and in his country brother. In the open season for game, should the former, having in mind this theory as to the title of wild game, shoulder his gun and betake himself to its haunts to realize on his property which the state has so carefully preserved for him, the bristling signs on every hand confronting him, bearing the warning "No Hunting Here," will impress him with the fact that realization on his property rights in the wild game is attended with many serious difficulties, unless, as in Frost's painting, "The Conciliator," he has had the foresight to provide himself with the necessary flask, the presentation of which so frequently causes the stern features of the horny-handed owner of the land to relax and warm into a welcoming smile, as he accepts this "key" to his hunting grounds.

In any event, such a property owner and the hunter of wild game is apt to gain an exaggerated idea of the rights of the owner of the land over which the game roams. As a matter of fact, however, the owner of the land has a very slight property right in the wild game thereon. Whatever the character of this right, the land owner possesses no right to kill wild game out of season, or otherwise, in violation of the law, even on his own land.

In the United States the phrases "Game Protection" and "Wild Life Conservation" are synonymous terms and have a distinct and well understood meaning which, in effect, amounts to this: the enactment and enforcement of laws for the preservation of all species of birds,

animals and fish of a wild nature for the benefit of all of the people in common.

When we speak of game protection we should keep in mind that there are two distinct and entirely different systems of protection in vogue throughout the world. The one that is already referred to, and may be termed the governmental system, whereby the supreme power of the state or nation decrees that the wild game and fish shall not be promiscuously slaughtered at will, but only under suitable regulations, to the end that it be conserved in the interests of all of the people in common. This is the only system we recognize at this time in this country. It is the only proper one for any country wherein the people are recognized as sovereign, and thousands of leading citizens all over the United States are working unselfishly to make this system a complete success.

The other is the private or individual system of protection, by which interested persons employ the means at their command and within their knowledge to conserve and increase the supply of wild game for their own use and benefit, without any consideration whatever for the general public in so doing. This latter system prevails largely in Great Britain and on the European continent.

It may be well to call attention to the fact that history shows that the former theory was anciently adopted in all European countries, but, by reason of indifference upon the part of the general public, it proved ineffectual in conserving the game, and the other system finally supplanted it. It appears that the people of those countries, like those in this country in recent times, took little interest in preserving their wild game. They considered all laws harsh and repulsive to a degree, and bent their energies more in the direction of pursuing and destroying game than in protecting it, with the inevitable result, when the scarcity of game became so appreciable as to cause alarm, the wealthy, aristocratic class took the matter in hand and began to propagate and protect game and other wild life systematically on their great landed estates for their own private recreation and enjoyment.

Now, as surely as the morning follows the night, that same change of system will occur in this state and in every state in the United States unless more active interest is taken in our present governmental system of fish and game protection by the people at large.

We may see the forerunners now of the private system of game protection in this state and in every state in the United States. Immense tracts of wild lands and marsh lands are being bought, leased and otherwise secured by wealthy sportsmen, either individually or associated with others in clubs, for private game preserves, and we hope the public in general is awakening to the true significance of this movement.

But it will not do to condemn these sportsmen when we remain wholly indifferent to the cause that is back of this move. We should first prevent the cause and then the effect will not follow. As long as there is a fair supply of game and wild life for all classes, there will be no incentive for this individual system of game protection; but when the game fields and public waters become depleted of game, fish and other wild life, the incentive to establish private game preserves is very great.

The question is: Can the governmental system of wild life protection and conservation be made a success? In other words, can a fair supply

of fish, game and wild life for all of the people be preserved and maintained by means of wise laws?

With a single qualification, we answer emphatically "Yes."

The qualification consists in this: Concurrently with the enactment of the laws, we must establish a campaign of education to bring public sentiment over to the support of the laws.

The people must be made to appreciate the real value of a supply of wild life to themselves, individually and collectively.

The public must be given to understand that the fish and game laws are enacted for the general public good, and not in the interest of any privileged few or special class.

Thus enlightened, public sentiment will exercise its powerful influence for the enactment of sane, simple and scientific laws that will protect and conserve the fish, game and wild life supply of the state, for the benefit and enjoyment of all of the people of the state.

We now come to what, in the past, has proven to be a fatal weakness in our governmental system of fish, game and wild life protection, viz., the lack of proper public sentiment and support for the strict enforcement of the laws.

It ought not be necessary to call attention to a matter which should appeal to ordinary reason as an obvious fact, and common sense should dictate that fish and game laws are of no value as such to accomplish anything without being enforced.

Of what avail are laws for the protection and conservation of fish, game and wild life, unless properly and strictly enforced?

Annually individuals and representatives of associations and clubs appear before their state legislature in the interest of fish, game and wild life legislation, and labor unceasingly for the enactment of new laws. Yet, after the enactment of such laws, how many individuals, associations or clubs do we find exerting themselves in the least toward securing public sentiment in support of the laws, or for those whose duty it is to enforce them?

The truth is that the enforcement of the laws is the prime necessity and the prerequisite to the success of any governmental system of fish, game and wild life protection, without which all other efforts are foredoomed to utter failure.

By enforcement of the laws we do not mean sporadic attempts to enforce the laws, but vigorous, continuous, consistent efforts to obtain their full benefit. Nothing is so conducive toward educating the public as to the value of wild life as a rigid enforcement of the laws.

When those who violate the law are brought to book for their offenses they are quite apt to give the matter some study and reflection, which in the end will convince them and their friends of the error of their ways.

There is no way of testing the efficiency or benefit of a law save by its rigid, continuous and consistent enforcement. If strict enforcement of the law proves it to be defective for its intended purpose, then it should be amended or repealed. Otherwise there is no means of securing accurate information on the subject.

The constant changing of fish and game laws at each recurring session of the state legislature, without a practical test of the law, has been the one serious evil in the past. It seems to have become a prevailing fashion, when one state enacts an experimental fish or game law, for the other states to follow suit and do likewise without any thought for the local conditions.

As a matter of fact, however, it often happens that what would be a wise and beneficial measure in one state to meet conditions which there prevail may prove utterly foolish and disastrous in another state, where the conditions are wholly different.

Some of the sponsors of experimental fish and game laws are mere theorists who have no practical knowledge of the effect of the measures they advocate, and are unfamiliar with the conditions that exist even in their own communities.

In the past, fish and game laws were considered to be more or less of a novelty or farce, and the matter of their enforcement a joke, with the result that it was difficult to impress the majority of the people as to the value and necessity of the laws. This sentiment on the part of the general public made the enforcement of the laws an onerous and difficult task for those whose duty it its to execute the law.

While it is true that the title to all wild game is in the state, and that the owner of the land on which it dwells or roams has only a qualified property interest in it, as he has a right to exercise inclusive and absolute domain over his landed estate, so he has a right to protect the wild life upon it; therefore he has the power to prohibit any and every person from shooting upon his lands.

Where the woods and wild lands have been supplanted by orchards, vineyards and fields of waving grain, the farmer stands guard and the "No Hunting" sign confronts the sportsman today.

While there is, and of right ought to be, a limit to the landowner's right to control the wild game on his lands, the time has not yet come in this country for a landowner to open fire upon an amateur sportsman and make his wife a widow and his children orphans. There are not, however, indications that we are moving in that direction.

Submitting all the facts to a candid world, it is respectfully urged upon all amateur sportsmen that they respect the rights of the farmer and landowner, and that they appreciate the privileges granted to the sportsmen by them, or the acts of vandalism committed by irresponsible hunters on the lands of the farmer and landowner may lead to the enactment of more rigid laws for the protection of the farmer's property, and thus further curtail the present rights of the amateur sportsman.

BIOLOGICAL SURVEY OF THE LAKES, RESERVOIRS AND STREAMS OF SAN DIEGO COUNTY

By Geo. A. Coleman

In January, 1927, I began a study of the lakes, reservoirs and streams of San Diego County in order to determine the exact conditions existing therein as a basis for stocking with the proper varieties of fish.

As the most of these lakes and reservoirs are the source of the domestic water supply of the city of San Diego and adjacent territory, their stocking with fish presents a serious problem. The water supply must be kept clean and sanitary, which involves treatment regularly during the summer months with copper sulphate and continuous chlorination. The effect of these treatments on the fish and fish food has been a very interesting study. For the purpose of a better understanding of the problem, the field data on each lake, reservoir and stream is appended as completely as I have been able to make it up to the present time, along with the results of some of the fish planting.

During the past week, January 20–25, 1930, I have visited again some of these reservoirs and had a chance to observe the pond-holding system now in use and the results of holding trout fry in these ponds during the past two months.

The holding ponds in use in Upper and Lower Otay lakes received my particular attention. Both of these ponds are described in the preliminary report and it is unnecessary to repeat here, since they are both in the same condition as in 1927.

On November 21, 1929, these holding ponds were stocked with brown trout from a shipment of approximately 50,000 fingerlings made by the Division of Fish and Game from Mt. Shasta Hatchery. Mr. Webb Toms, deputy in charge of these holding ponds, informs me that 15,000 of this shipment were placed in the cement holding pond at the Upper Otay Dam and the balance, 35,000, in the cement holding pond at Lower Otay.

The pond at Upper Otay Dam receives its water through a small pipe located about midway in the dam between the bottom and top. This water is not chlorinated and no copper sulphating has been done for some time. On the occasion of my visit to it on January 21, 1930, I tasted the water and observed the odor and found nothing objectionable in either.

I took specimens of the fish in this pond, the average of 100 or more, which I found to be in good physical condition. In the lot captured were two five inches or over in length, but the great bulk of them, probably 95 per cent, ran from two and one-half to three and one-half inches in length. Just as in any pond system, where no effort is made to segregate them from time to time according to sizes, they are of all sizes, and an examination of the stomachs of the larger specimens would reveal the remains of many of their lesser fellows.

The holding pond at Lower Otay is the same as described in my report of January, 1927, and the same as mentioned in the article by Mr. Muehliesen in CALIFORNIA FISH AND GAME, October, 1929, pp. 314–316, Fig. 104.

This pond now receives its water supply from the main pipeline and is taken off just below the chlorination plant. As it is less than 1000 feet from the chlorination plant, the water supplying the pond receives the full dosage of chlorination daily. Consequently the 35,000 brown trout fry placed in this holding pond November 21, 1929, did not do as well or make as good growth as those in the pond at Upper Otay. On January 15, 1930, Mr. Toms sent specimens of these trout, which, on examination, showed symptoms of having been gassed. On January 21, 1930, in company with Mr. Toms and Mr. R. C. Wueste, supervisor of the water impounding system of the city of San Diego, I investigated the conditions at the Lower Otay Dam and Pond. I found that the pond had not been cleaned since the fish were put in two months before. There was a great accumulation of algae on the bottom and walls of the pond, which they were endeavoring to clear up by the use of copper sulphate. Mr. Wueste stated that on December 28, 1929, there occurred a great overdosage of chlorine in the water in the pipeline and that the water in the holding pond received the full dosage. Mr. Toms reported that the fry in the pond immediately showed signs of distress by whirling rapidly around, finally coming to rest with the head down, in which

position they died and sank to the bottom, where they turned black in a very short time. They died off so rapidly that on January 17 what were left, estimated at 5000, were turned out into the lake.

Mr. Toms reported that the steelhead fry placed in the small pontoon cages at Barrett Lake were not doing as well, or making the growth, as the brown trout in the pond at Upper Otay.

Under date of January 23, 1930, Mr. Wueste wrote me as follows: "I am a believer in making haste slowly about some things. This is especially true of questions which have good arguments on both sides and require a considerable time to determine by actual experiment. One such question in my mind is the efficacy and economic wisdom of trout planting in San Diego County. I expect some time later this year to compile data on trout planting in San Diego County, with results to the fishing public. It occurs to me that an equal amount of time, effort and money devoted to fishes more suitable to the local environment might have yielded immensely more satisfactory results.

"What is your opinion on the suitability of the large and small-mouthed black bass in San Diego County? Also, what other fishes do you believe would thrive equally well here and get along neighborly with the black bass?"

CONCLUSIONS AND RECOMMENDATIONS

It is very evident from a study of the data obtained in the survey of these lakes and reservoirs that the temperature, food and other conditions make them more suitable in general for bass, crappie, bluegill, sunfish and perch than for trout. Lake Cuyamaca is the only real trout lake in the county.

The effort to stock these lakes with trout is, therefore, an attempt under the handicap of natural conditions and, while it may succeed to a limited extent with the brown trout, which is the only species of trout in any way suited to the conditions in most of these reservoirs, it is bound to be an expensive undertaking, both in money and fish.

It seems to me that much more satisfactory results would be obtained by working *with* nature in the stocking and maintenance of species of fish in each lake which are suitable to the environmental conditions in that lake.

The bass, crappie, bluegill, perch and several species of sunfish will stand a much stronger dosage of copper sulphate than trout. Since nearly all of these lakes require treatment with copper sulphate during the warm summer months and continuous daily chlorination, these species of fish would be much more likely to succeed under the conditions than trout. The natural food in these lakes is also just what is required by these fish.

As a further and conclusive argument in favor of bass, crappie, perch, sunfish and bluegill, especially the latter, they are species of fish which can be caught with little effort by people who are not expert sport fishermen, but who enjoy catching and eating a few fish. As the city of San Diego is anxious to promote general camping, picnicking, boating and fishing at these lakes and reservoirs, it seems to me this is the solution of the problem.

Berkeley, California, January 30, 1930.

FIELD NOTES ON BIOLOGICAL SURVEY OF LAKES, RESERVOIRS AND STREAMS OF SAN DIEGO COUNTY (PRELIMINARY REPORT)

January 20 to 26, 1927.

RESERVOIRS: Upper and Lower Otay lakes. Located 19–21 miles southeast of San Diego.

Upper Otay: Elevation, 521 feet. Temperature of water, 57.8° F. Capacity, one billion gallons. Frersh water algae: Bacillariaceae (diatoms), very abundant; (Closterium), abundant; Spirogyra, *Zygnema,* etc., abundant. Plankton: Water fleas (*Daphnia pulex*), very abundant. Copepods: *Cyclops biscuspidatus,* abundant. *Diaptomus bakeri,* very abundant. (20 minutes towing yielded 1 ounce solid material.) Fish: Black bass, crappie and bluegill planted here are reported to be doing fine; no trout.

Lower Otay: Elevation, 399 feet. Temperature of water, 57.8° F.. Capacity, 19 billion gallons. Sample at 50 feet, dissolved oxygen==98% saturation; carbon dioxide ==20 pts. per million. Sample at 20 feet, dissolved oxygen==118.2% saturation; carbon dioxide==20 pts. per million. Sample at 107 feet, dissolved oxygen==98% saturation; carbon dioxide==20 pts. per million. Hydrogen-ion-concentration of all samples==Ph. 7.8 (slightly alkaline).

Fresh water algae: Bacillariaceae (diatoms) very abundant in surface water. Closterium, very abundant.

Plankton: Water fleas (*Daphnia pulex*), very abundant. Copepods (*Cyclops bicuspidatus*), very abundant. (*Diaptomus bakeri*) (found at 50-107 ft. depth). (20 minutes towing yielded 1 oz. solid material.)

Fish: Black bass, crappie and bluegill said to be fairly abundant. Trout introduced here seem to be very scarce, which is laid to bass eating the fry.*

Larger insects: Dragon fly larvae abundant in algae along shore.

Higher crustaceans: The "Scud" (*Hyalella knickerbockeri*) was dredged up from the bottom in 15 feet of water and seemed to be fairly abundant on algae covered limbs.

TROUT NURSERY POND: At lower Otay Dam. This pond is one of the best I have seen. Cemented sides and bottom, water well aerated by a continuous stream from hydrant and tiny streams from an encircling water pipe; shade furnished by a covered pergola. Fresh water algae are very abundant; spirogyra, zygnema, etc., forming a thick mass on the bottom at present, which later spreads over the surface. Plankton: Water fleas; wheel animalculae; ciliate protozoa; very abundant.

The trout fingerlings here look very well (only a few with fungus spots). They vary in size from 3 to 6 inches. Only a few hundred could be seen. Still being fed, although there is an abundance of natural food.

HOLDING POND AT UPPER OTAY DAM. This pond is on the lower side of the upper Otay Dam, receiving its water through a pipe from the reservoir above. It is constructed by using the natural rock wall on the upper side, while the outer side is of concrete; bottom of earth and concrete. It is about 8 feet in depth and 20 feet long. All the aeration the water gets is what is brought in at the surface from the inch pipe supply. The lower third of this tank is now covered by boards, which are not shown in the photograph.

Just as in all other ponds, the large trout eat the small ones, only a few hundred being visible when fed. They are of all sizes from 3 to 6 inches in length, except that here the small seem to predominate. Mr. Toms says they do not grow as fast here as in the pontoon cages. The natural feed is not very abundant in this pond. There is no way of cleaning it; hence in all probability the bacteria of decomposition use up the oxygen which would otherwise be available for the trout. No attempt at segregation has been made in this tank. As it is a hundred feet, or more above the level of the water in the lower reservoir, it will be necessary to dip the trout fry out when they are to be planted, and I am not sure that any way was provided for drawing down the water in order to do this.

PONTOON CAGES AT LOWER OTAY. These cages are constructed as follows: A framework of 2 by 4, covered with a very fine meshed screen on the sides and bottom; top covered with heavy chicken wire over which removable boards are laid. Mounted on woodpipe pontoons, with screw levers at each corner so that they can be raised ont of the water for cleaning and lowered again without disturbing the fry in any way.

Size 20 feet by 20 feet by 10 feet in depth and when lowered there is about eight feet of water in the cage. They can be moved about and anchored anywhere, which is a great advantage during warm weather. The only trouble seems to be in getting a good circulation of water through them (on account of the fine meshed wire). During the warm summer, when the surface is very quiet, it is absolutely necessary that some means of circulating and aerating the water be provided. This was accomplished this last summer by running an Evenrude at one end. A better plan, it seems to me, and I so recommended, would be to provide a pipe coming up through the bottom and producing a spray over the surface. A small electric centrifugal pump, with which the cooler water from the bottom could be brought up and sprayed over the surface of the water inside the tank would, I believe, solve the problem. The trout in this cage are in fine condition, larger, 4 to 7 inches in length. than in either of the ponds.

I believe, therefore, that the cage, provided the suggested improvements for aerating the water are made, is the solution of raising trout in these lakes to a larger size. However, the cage is subject to the same objection as the pond, viz, the larger fry will eat the smaller. The only way to overcome this difficulty is to put movable partitions in the cage made of wire mesh. This, together with a separat-

*I believe that on account of the abundance of the above bottom feed it will be found on investigation that the trout are at the bottom feeding this time of year and possibly in the warm summer months and have not been destroyed by the bass.

ing screen of wire mesh which will permit separating the smaller ones from the larger without handling them at all, will, I believe, make the cage the ideal arrangement.

MURRAY RESERVOIR. Located 10 miles northeast of San Diego. Elevation 440 feet. Capacity 2 billion gallons. Temperature of water 55.0° F.

Fresh water algae: Bacillariaceae (diatoms), very abundant; *Fragillaria crotonensis* (floating colonies), very abundant.

Plankton: Water fleas (*Daphnia pulex*), very abundant; Copepods (*Diaptomus bakeri*), very abundant; Wheel animalculae (*Anarthera aptera*) common; Protozoan flagellates, common; *Volvox perglobator*, forming green scum.

Fish: Bass, crappie and bluegill, said to be doing fine.

Pontoon cages are not so elaborate as the one in lower Otay. A large one and two smaller ones have been provided and an attempt at segregating was made. When they were separated about a month ago, only six hundred large ones were found and removed to one of the smaller cages. "The thousands" left were called up to feed, but only a few hundred were visible. What I did see were all sizes from 3 to 5 inches in length.

Recommendations: The same objections apply to these cages as to the one at lower Otay, viz, no means provided for circulation of the water. If, therefore, it is desired to keep the trout fry during warm weather, it will be necessay to provide means of aerating the water, and the same plan as outlined for the lower Otay would apply here. Otherwise, it will be necessary to turn the fry out before hot weather comes on.

BARRETT LAKE. Location 40 miles east of San Diego. Elevation 1306 feet. Capacity, 14,500,000,000 gallons. Temperature of water, 49° F. Color of water, very murky. Bottom: Mud and muck of dark colored decaying vegetation, with odor of H_2S. No large green plants.

Fresh water algae: Very sparse (a small amount of spirogyra on rocks around part of shoreline).

Plankton: Practically all of the tow-net plankton collected from the surface consisted of one species of water flea (*Chydorus popei*) a species not found in any other lake or reservoir. *Daphnia pulex*, found in abundance in other lakes is here very scarce. Likewise, *Cyclops bicuspidatus*, abundant in other lakes, is here very rare.

Insects: The only insect found in any abundance was the "red larvae," a species of *Chironomus* found in abundance in the bottom mud. This species is the same as the one found in mud potholes in Clear Lake, Lake County; hence indicates that very much the same condition occurs here, viz, an accumulation of decaying vegetation in the deeper holes and potholes in shallow water. There is, in this lake, a very greatly unbalanced condition, owing to the lack of green vegetation of the higher plants, and of fresh water algae, which would cause a lack of oxygen and an oversupply of carbon dioxide.

Fish: The effect of the above conditions was well illustrated following the last rain, when the keeper took out 77 dead perch which had floated up around the dock. I found one which had been dead for some time and was covered with a heavy growth of white fungus.

Recommendations: If it is desirable to stock this lake with fish, it will be necessary to change the above conditions by the planting of green vegetation around the upper end, especially where the Cottonwood Creek and other creeks enter, viz. such plants as crowfoot, potamogeton and watercress, which would gradually spread and furnish a place for insect life to breed. Something could also be done in the way of removing dead trees and bushes from the upper end and coves.

MORENO RESERVOIR: Location, 59 miles southeast of San Diego. Elevation: 2915 feet. Capacity: 17,333,000,000 gallons. Temperature of water 46.4° F.

Fresh water algae: Bacillariaceae (diatoms) abundant; *Cladophora* sp., abundant on rocks.

Plankton: Practically the entire tow net plankton collected from the surface consisted of two species, *Daphnia pulex* and *Diaptomus bakeri*. These are very abundant; however, 20 minutes towing resulted in about 2 ounces of solid material.

Insect life: The larger water insect larvae, Dragon and damsel flies, water bugs, etc., are very abundant around the upper and southeast shoreline, where there is a great area of submerged grass land and green vegetation.

The only trouble here, so far as I could see, would be the varying conditions produced by the rise and fall of the lake, which may amount to as much as forty feet. It is about forty feet below the overflow of the dam at present and is likely to remain so for a long time to come.

Fish: There are said to be sunfish and small minnows in this reservoir in great abundance. It has been planted entirely with the brown trout, which have not begun to show up very much as yet; that is, they are not readily caught; therefore, "very scarce." Deputy Glidden caught one about 16 inches long last summer, which he said was fat and in fine condition physically.

Recommendations: That the planting of the brown trout be continued here, to the exclusion of other trout, just to make a test case of whether they can exist and increase.

LAKE HENSHAW: Location, 66 miles northeast of San Diego. Elevation, 2650 feet. Capacity, 53,500,000,000 gallons. Temperature of water, 46.4° F.

Blue green algae (*Clathrocystus*) very abundant.

Fresh water algae: Bacillariaceae (diatoms) abundant. Bacillae,* several species, mostly rod shape, very abundant along with the blue green algae in surface water.

*The presence of these bacillae along with the blue green algae would indicate that there is a very heavy growth of fresh water algae and all plankton during the summer months which dies down and sinks at the approach of winter conditions, producing a mass of decaying matter from which these bacteria obtain their food, but which they are working over into assimilable food for the new crops of algae and plankton.

Plankton: Water fleas (*Daphnia pulex*), very abundant. Copepods (*Cyclops bicuspidatus*) (*Diaptomus bakeri*), about equally abundant and sufficient at present for a good supply of fish food.

It would appear that there is an abundant supply of food for all kinds of fish in this lake. The only danger being that they are smothered with the heavy growth during the summer.

LAKE CUYAMACA: Location, 56 miles southeast of San Diego. Elevation, 4600 feet. Capacity, 3,500,000,000 gallons. Temperature of water, 44.6° F.

Fresh water algae: Bacillariaceae (diatoms), abundant; Desmids (*Closterium* sp.), abundant; *Spirogyra*, abundant; *Zygnema*, abundant.

Plankton: Protozoa (ciliate), very abundant, several species; Wheel animalculeae (several species), very abundant; water fleas (*Daphnia pulex*), very abundant; (*Chydorus popei*), a few; Copepods (*Cyclops bicuspidatus*), (*Diaptomus bakeri*), both very abundant.

Fish: Rainbow and steelhead, both doing fine. This is a real trout lake.

Holding Pond: Was submerged in storm and fish escaped.

Recommendations: That the planting of rainbow and steelhead be continued.

SWEETWATER LAKE. Location, 10 miles southeast of San Diego. Elevation, 142 feet. Capacity, 10,000,000,000 gallons. Temperature of water, 53.6° F.

Fresh water algae: Bacillariaceae (diatoms) very abundant; *Spirogyra* and *Zygnema*, abundant.

Plankton: Copepods; *Daphnia pulex* and *Diaptomus bakeri*, in about equal numbers form the entire net plankton. They are about ten times as abundant here as in any other lake, which is presumably due to the lower elevation and higher temperature of the water at this time of year.

Water insects: All kinds are very plentiful.

Fish: Sunfish and perch are exceedingly abundant. Crappie and bluegill need replenishing. This would be a good bass lake, but I would not recommend it for trout.

LAKE HODGES AND SAN DIEGUITO RESERVOIR, not visited.

RIVERS AND STREAMS. The San Diego River probably carries the largest amount of water during the winter months, but goes entirely dry very early in the season. A large dam is being constructed, which will make a very large reservoir on this river. Another dam is also being constructed on a tributary, which will also make a reservoir.

Up the coast, Santa Margarita River and Escondido Creek are the only streams which have any water during the summer and are therefore eligible for trout. The amount of water depends, of course, upon the snow and rain, and they may go dry any summer.

Sweetwater River, I believe, always has a fair flow of water, and is therefore a fair trout stream, especially at the upper part. It is a good sized stream now.

Cottonwood Creek has very little water in it now and soon will be entirely dry.

Pine Valley Creek comes under the head of mountain streams, and is the only real little mountain trout stream in the county.

There are several other small mountain streams which might some years support trout, and where they enter a lake might afford some spawning ground for trout. These, however, are limited in extent, and subject to drought and high water conditions to such a degree that they are very undependable.

General Considerations and Recommendations: On account of the limited number of streams, and the fact that most of these streams are subject to drought and high water conditions, it is vey evident that the supply of sport fish must be furnished by the lakes and reservoirs, and with San Diego's rapidly increasing population, this will become a very serious problem, not only from the point of the sportsmen in furnishing a supply of fish, but from the sanitary standpoint, as camp grounds and picnic grounds are being established at all these lakes and reservoirs. It is now under the permit system, and supposed to be regulated according to strict sanitary practice. However, the feeding of the fish in these reservoirs will bring up a problem; the pollution of the water, which I believe, no one has yet thought about. The city is beginning to establish chlorination plants on some of them and it will be an interesting study to see how this will affect the fish and the plankton and insect life.

As the season advances and the water warms up during the summer months there is produced an enormous growth of fresh water algae and plankton. I understand this begins about June 1.

It would be a good thing to make a study of the conditions in these lakes, reservoirs and streams, during the latter half of June and possibly the early part of July in order to watch the effect of this growth on the fish in the lakes and streams. If, also, some of the trout fry in the cages and ponds could be held and released at this time, a study could be made of their fate after release.

I would therefore recommend that since the sportsmen, city authorities and county supervisors are all so much interested in developing the fishing in these lakes and reservoirs and perfectly willing to bear all expenses incurred for construction and maintenance of the pontoon cages, that this system be given a thorough trial, and that I be given authority to assist them in any way possible by suggestions as to the reconstruction of the existing pontoon cages and for improvements in any new ones constructed.

A continued study should be carried on from time to time of the conditions existing in these lakes and reservoirs, both as to the food supply for fish and the general health of the fish; also, a bacteriological survey of the waters from time to time to determine whether any infectious diseases are developing from the handling of the fish.

FIELD NOTES ON BIOLOGICAL SURVEY OF LAKES, RESERVOIRS AND STREAMS OF SAN DIEGO COUNTY (SUPPLEMENTARY REPORT)

LOWER OTAY LAKE

	Temperatures July 16, 1928, 10 a.m.
1 foot depth	76° F.
10 feet depth	76° F.
20 feet depth	75° F.
30 feet depth	64° F.
40 feet depth	56° F.
50 feet depth	55° F.
60 feet depth	55° F.
70 feet depth	55° F.
Upper east arm—shallow water	82° F.
North tule cove—shallow water	81° F.

(Taken from the records kept by the keeper of the reservoir.)

Plankton: Flagellate Protozoa: *Volvox perglobator*, all *Ceratium hirundinella*, abundant *Pleodorina californica.*

Diatomaceae: *Fragillaria* sp.; Rotatoria: *Synchaeta* sp., *Notops* sp., *Asplanchnopu* sp., all common; Oladocerca: *Scapholoberis mucronata*, abundant; Copepods: *Cyclops biscuspidatus*, abundant; *Hualella knickerbockeri* ("Scuds"), abundant.

Large aquatic insects: Damsel fly, dragon fly, may fly, all abundant.

Large aquatic plants: Wild sago, *Potamogeton*, forming heavy growth around margin.

Fish: Bass and bluegill, crappie, few trout. All in good condition. Young bass very abundant.

MURRAY RESERVOIR. July 20, 1928. Temperature: Open water, surface, 8 a.m., 76° F.

Plankton: Abundant, consisting of *fragillari, volvox, ceratium, cyclops, daphnia*, scuds.

Insects: Damsel fly, dragon fly, may fly.

Plants: Potamogeton and ranunculus, very heavy growth; a few tules.

Fish: Bass and bluegill. Young trout in cage, ¾ inch long.

Recommendations: That pontoon cages be made smaller, long and narrow, and that they be moved to new locations occasionally, in order to get new natural feed.

BARRETT LAKE. July 19, 1928. Temperature: Open water, surface, 77° F.

Plankton: Ceratium, chydorus, cyclops, very scarce.

Blue green algae: All killed by bluestoning which is carried on regularly.

Plants: Heavy growth of wild sago, exclusively.

Fish: Perch are still fairly abundant.

In general, the condition of this lake seems to have improved since January, 1927, due, no doubt, to the growth of wild sago which furnishes a breeding place for aquatic insects and stationary plankton.

Recommendations: It might be well to plant sunfish in this lake to see if they would survive and furnish food for bass.

MORENO RESERVOIR. July 19, 1928. Temperature: Open water, surface, 78° F.

Fresh water algae: Abundant.

Blue green algae: Mostly killed by bluestoning.

Plankton: Abundant, consisting of protozoans (rotifers), *Cyclops* and *Hyalella knickerbockeri.*

Insects: Dragon fly, may fly, etc.

Plants: Wild sago and Potamogeton.

Fish: Bass and bluegill. (I saw and photographed a fine catch of 2 to 3 lb. bass.)

Recommendations: I examined Dr. Wilson's reports on this lake and found there was a heavy growth of Anabaena in March, which was mostly killed by bluestoning in April. As some other algae and diatomaceae are now showing increase in numbers, I recommended bluestoning lightly again right away. This is a good illustration of what may be accomplished by intelligent bluestoning in order to keep down the injurious algae and not injure the fish.

CUYAMACA LAKE. July 17, 1928. Temperature: Open water, surface, 70° F., 11 a.m.

Fresh water algae: *Hormidium, Pediastrum*, abundant; Diatomaceae: *Navicula, Encyonema.*

Plankton: *Ceratium* most abundant species; *Brachionus*, second; *Sida*, third.

Insects: Dragon and damsel fly, abundant.

Plants: Potamogeton almost exclusively, heavy growth.

Fish: Minnows (shiners), viviparous perch, trout, 3 to 5 lbs., bass. (It was reported the keeper had introduced bass from another lake very recently.)

LAKE HENSHAW. July 17, 1928. Temperature: Open water, 82° F.

Fresh water algae: *Spirogyra, Mougetia, Hydrodictyon*; forming scum which floats into all the shallow bays and along sandy shores.

Diatomaceae: Navicula.

Plankton: Abundant, consisting of Brachionus, Chydorus, Cyclops Nematodes (Trilloba), abundant.

Insects: Damsel and dragon fly, water beetles.

Aquatic plants: A few tules, others very scarce.

Fish: Perch, abundant; brown trout have been planted; bass, a few; fishing not good.

Recommendations: That minnows be introduced, which can be had in abundance at Lake Cuyamaca.

SWEETWATER LAKE. July 20, 1928. Temperature: Open water, 8 a.m., 80° F.

Fresh water algae: Very abundant.

Plankton: Very abundant, consisting of rotifera, crustaceans and scuds.

Insects: Dragon and damsel fly; may fly; snails, abundant.

Plants: Wild sago; potamogeton and a heavy growth of chara.

Fish: Bass, fine. So many young bass that fishermen complain of having to put back so many undersized.

LAKE HODGES. July 17, 1928. Temperature: open water, surface, 80° F.

Fresh water algae: Very abundant.

Plankton: Abundant, consisting of protoza, diatomaceae and crustaceans (scuds abundant).

Insects: Abundant, especially a very large may fly.

Fish: Perch, bass, trout; fishing for all species excellent.

STREAMS: PINE VALLEY CREEK. July 17, 1928. Temperature in pools, 78° F.

This little stream is well supplied for its entire length with water plants: Ranunculus and fresh water algae, which furnishes a fine breeding ground for insects, viz., may fly and stone fly, caddis fly.

Fish: Hundreds of young trout, 3 to 5 inches long in every pool.

PAMAU CREEK: We visited it back of Pala Indian Reservation and found most of water had been taken out for irrigation. Farther up Glidden reports more water and fishing conditions good.

General Recommendations: In a talk with the officers of the Sportsmen's Association at a luncheon tendered me at the San Diego Athletic Club, it was brought out that this club is very anxious to give every assistance to the commission in the work of stocking the lakes, reservoirs and streams of San Diego County with fish.

They are now constructing four 400 gallon tanks and an oxygen equipment, to be used on a large truck for transporting fry, or larger fish. They will attend to the reconstruction of the pontoon cages and are willing to bear the expense of any other experiments we may desire to inaugurate.

In a conference with the superintendent of the San Diego City Water Supplies, I learned that the city is very anxious to have the trout planting in the reservoirs controlled by the city continued. Although the superintendent stated that some of these trout had already cost them at the rate of $130 each, he would be glad to continue regular annual appropriations for this work.

With regard to the bluestoning of those lakes and reservoirs controlled by the city, Dr. Wilson of Los Angeles is on their regular payroll charged with making weekly examinations and reports on the algae in all the reservoirs. The superintendent gave me free access to Dr. Wilson's reports for six months past. I find that Dr. Wilson only considers the diatomaceae and blue green algae, which are likely to cause bad odors or tastes in the domestic water supply. His counts are therefore confined to about three species, *Navicula* and *Fragillaria* (of the Diatomaceae) and *Anabaena* (of the blue green algae). His work, therefore, has no bearing on the matter of a supply of fish food, except as the species studied by him, or the bluestoning of the reservoirs may affect the fish life.

The superintendent stated that he would be very glad to have me consult with Dr. Wilson and continue my studies of these lakes and reservoirs, in order that there might be no conflict between the water department and the Fish Commission in the matter of bluestoning.

Since it is an absolute necessity to bluestone these waters in order to make them fit for domestic use, it would seem that we are bound to exercise regular control over the bluestoning.

Sanitary Regulations: The city is putting in force rigid sanitary regulations with reference to the use of the reservoirs and lakes controlled by them by visitors, campers and fishermen.

The city has a big problem in the triple use of these reservoirs, and since they are one of the main sources of sport fishing in the county, we should give them particular attention.

THE BURRO DEER IN CALIFORNIA

By Donald D. McLean

The burro deer (*Odocoileus hemionus eremicus*) is a large, pale form of the Rocky Mountain mule deer found in the southeastern desert regions of California. It is found in the Colorado Basin principally south of Parker on both the California and Arizona sides of the river.

It was never a very common animal in California, being a Mexican species entering California via the Colorado Valley and found in the state only in small scattered groups in suitable locations. At one time it was thought doubtful if any still existed within the bounds of the state. However, it seems that there were some still in the state even at that time. Now it appears that burro deer are on the increase and in some sections are even present in considerable numbers. This is especially true of the territory adjacent to the Colorado River south of Blythe, Imperial County. The metropolis for the species in that area seems to be in the district about fifty miles south of Blythe in the vicinity of the Haslam ranch. During the dry seasons the deer are generally found nearer the river than during the rainy seasons when they often go out into the desert mountain ranges as much as sixty miles from the river. There are always some deer to be found in the mountain ranges even during the driest time of the year. They stay at that time within reach of springs and "tanks." Hunters and prospectors say that if it rains in a mountain range, even if it is miles away, the deer will go to it in order to secure the new fresh feed which starts up immediately after a shower.

The rainy season is generally during the late summer and early fall. At Desert Center on the Blythe to Mecca highway, we learned that not infrequently deer are secured in the Chocolate, Chuckawalla, Palen, Coxcomb and Granite mountains and also in the Black Hills during the rainy season.

Normally the burro deer is found either along the river in the jungle of arrowweed, willows, cottonwood, mesquite and screwbean or up the dry washes adjacent to and emptying into the Colorado. In the latter type of habitat they are associated with the ironwood, mesquite, palo verde and cat-claw. Their favorite food seems to be the tender terminal foliage of the ironwood and twigs of palo verde. They seem to use the large broad washes for traveling and feed principally in the narrow insignificant side washes, where they could be easily overlooked by anyone searching for them. When moving from one wash to another, they generally travel the wild horse and burro trails on the intervening ridges. Sometimes, especially during the rut, individuals travel great distances on these higher eminences. In the upper parts of their range they are associated with the desert mountain sheep, but on the whole the sheep range at a higher elevation than do the burro deer.

During the time from the 14th to the 20th of December, 1929, when this territory was visited, we saw little, if any, evidence of places where burro deer had come to water. Most of the "tanks" in the upper reaches of the washes showed no evidence of having been used by deer and only on rare occasions by mountain sheep. Coyotes and other smaller animals had been using some of these tanks extensively. There

were some old deer tracks along the edge of the Colorado River, where they had apparently come to drink, but this had been long before as the river had dropped several feet since they had been there.

Of the eight deer seen by our party, six were seen at from five to eight hundred yards; one forked horn was seen at about seventy-five yards for about two jumps; one large buck was seen lying down at about eighty yards with another smaller animal. The type of country in which they are found makes it extremely difficult to make a close approach as they can sight approaching danger at a considerable distance and the terrain is very rocky so it is difficult to progress without making a considerable amount of noise. The sound of rattling rocks in the desert is carried for long distances.

Although the actual number of burro deer found in that district would be rather difficult to compute, I am led to infer from the statements of local residents that they are increasing in numbers over their entire range in California as well as in the district below Blythe. The character of the country, the climate and the wariness of the animals makes the hunting during the open season rather difficult. At the time the season is open, the meat is apt to spoil before it can be gotten out to cold storage.

We are certain that in the district around the Haslam ranch there were no less than twenty-five or thirty head of deer at the time we were there; probably nearer forty. There were many fawn tracks, so apparently the reproduction is good. Most of the doe tracks were accompanied by two fawn tracks. They seem to travel in small groups of three to eight, but as many as twelve have been seen together by local residents.

The future of this large deer in California seems to be pretty well assured unless something unforeseen should take place. They were harassed several times by airplane hunters, but I understand such activities have ceased in California. Apparently only three bucks were secured by hunters in that territory during the season of 1929 and these were obtained by local people. Fortunately, residents of the region wish to perpetuate the animals, and are quick to take exception to law breaking.

PRELIMINARY REPORT OF THE EARLY LIFE HISTORY OF THE CALIFORNIA SARDINE

(A contribution from the Hydrobiological Survey)

By E. C. Scofield and M. J. Linder

One of the most important results of the Hydrobiological Survey* during the year 1929 was the discovery of the eggs and larvae of the California sardine. These forms were first discovered in a net haul made five miles northwest of Point Vincente on June 2, 1929. Though this is the first time that eggs and larvae of this species have been actually obtained and closely examined, W. F. Thompson, in 1918, expressed the belief that they occurred in this same region. During 1918–19 Thompson did considerable collecting in the Gulf of Santa Barbara in an attempt to locate the spawning banks of the albacore, and in his samples many varieties of fish eggs and larvae were found.

* An account of the organization of this survey and of its general program is to be found in the January, 1930, issue of this publication.

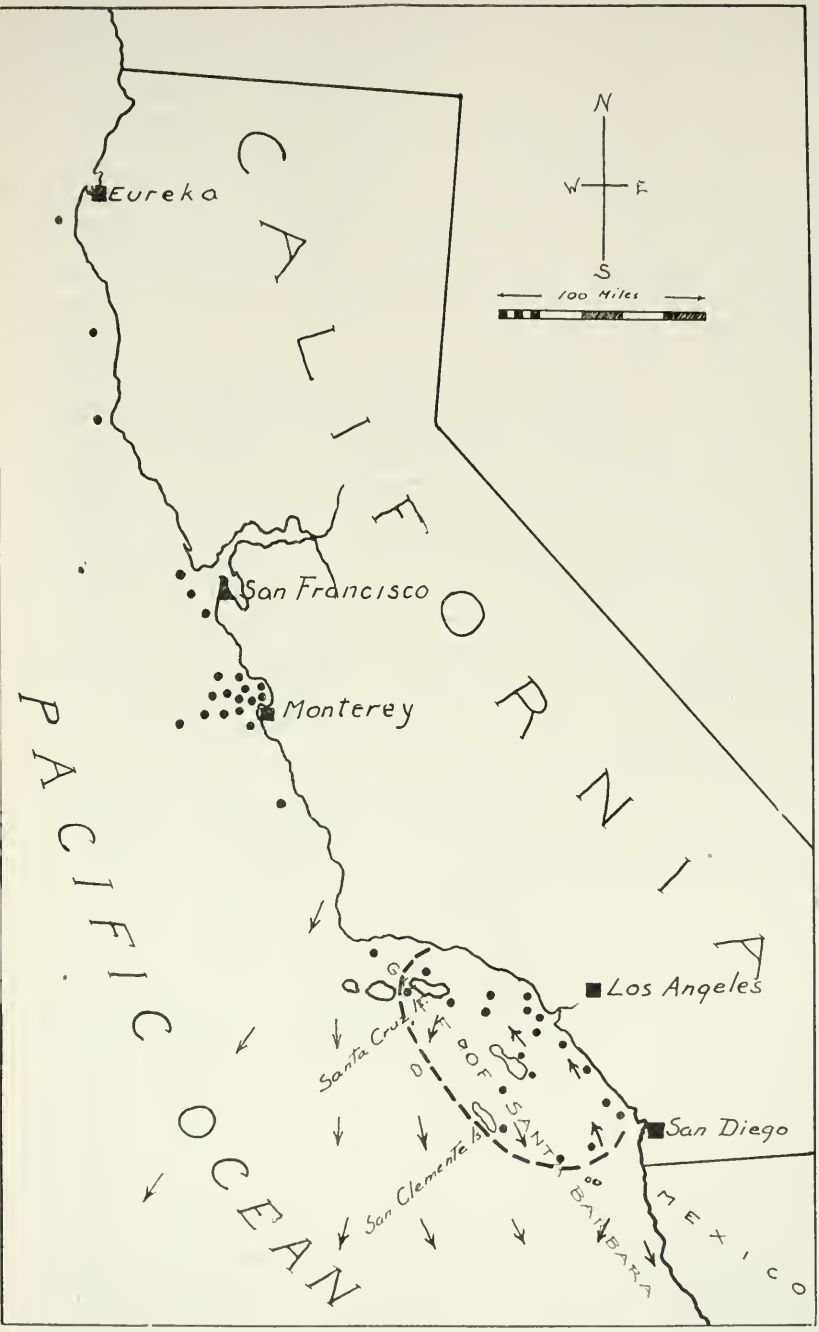


FIG. 35. Map showing the number and location of all the hauls made aboard the *Albacore* during 1929. The broken line encircles the area in which sardine eggs and larvae were found. All other hauls outside this area were negligible in their results. The arrows indicate the surface movement of the water for June, July and August as prepared by the Hydrographic Office of the United States government.

He was of the opinion that these young stages occurred in his material, especially since many young sardines as small as two centimeters (about ¾ inch) were recorded. His work, however, was never published and the eggs and larvae were left undescribed on his departure from the laboratory at San Pedro. Although his material was preserved, it has now deteriorated so that little or nothing can be gathered from it.

A part of the present program of the Hydrobiological Survey is the continuation of the pioneer work done by Thompson, namely: the pursuit of a better knowledge of the early stages of the more valuable marketable fishes as an important step in the conservation policy of the California Division of Fish and Game. With this general aim, we have selected the sardine as the object of our first investigation, since the California sardine fishery is the largest in this state as well as one of the largest of its kind in the world.

This program, which follows, is divided into three parts. The first step will be the determination of the exact spawning area of the sardine. The southern waters off Mexico, and the California current (the warm offshore current running south along the entire California coast) will be studied in order to determine if the sardines seek a common spawning area in the southern waters of this state; if they go farther south to spawn or if they go farther offshore for the same purpose. This information will be important with respect to our present hypotheses on migrations and races. It may be pertinent to emphasize in this connection that the length frequency data accumulated by the California Bureau of Commercial Fisheries during the past ten years, primarily for the purpose of tracing dominant year classes in an effort to determine the presence or absence of depletion in this species, undoubtedly will prove invaluable to us in our attempt to unravel the complicated appearances and disappearances which characterize the sardine along the California coast.

The second step in this investigation will be on early life history studies; that is, it will be concerned with a study of the rate of development of the eggs, the rate of growth of the newly hatched larvae, the drift of both while in these helpless stages, and the food of the larval and post larval stages. Egg development can be studied most definitely by securing and artificially fertilizing the mature eggs. Similarly, the growth rate of the very young larvae can be obtained in a fairly accurate fashion by hatching and artificial rearing. It will be necessary to discover, in the open ocean, the depths at which the eggs are laid, and whether they remain at the level in which they are deposited or whether they rise or sink in the course of their development. The drift of these stages will be determined with the aid of a current meter —an instrument that is capable of recording the velocity and direction of the current at any depth, provided the boat can be anchored. Food studies of the larvae may reveal important results. Lebour * states that metamorphosed forms of the European sardine up to at least 82 millimeters usually feed on mud containing microorganisms. If corresponding stages of the California sardine are found to behave similarly in their feeding, there will be offered an important aid in gaining information concerning their movements up to the time they enter the commercial catch as "quarter oils" or until they attain a size of 100 millimeters or more.

* Journal of the Marine Biol. Association of the United Kingdom. Vol. XII, Sept. 1921.

The third step in this investigation will be to ascertain yearly the success of spawning. This study will necessitate the making of an actual count of eggs and larvae from representative net hauls in certain localities during intermittent periods of the spawning season. Accumulated data of this nature will provide means for a measure of the abundance of the resulting adult fish and will aid in the explanation of the dominant year groups that come and go within the commercial catch. Also, it may show the actual condition of the fishery; that is, the same number of eggs and larvae obtained from year to year would tend to indicate a steady fishery, while annually decreasing amounts would probably indicate that depletion was occurring, due to the killing of too many adults or spawners. Periodical scarcities of the eggs and larvae, which are very likely to occur in any fishery, would probably be due to adverse spawning conditions, namely: physical and chemical conditions of the water. In such studies, however, one must be careful to distinguish between the natural and artificial causes of the fluctuations in abundance of the young stages.

At present, some phases of this program pertaining to the first step have been accomplished. The coastal waters have been explored for eggs and larvae to a distance of ten miles offshore from Eureka to San Diego. Monterey Bay, which is one of the main fishing centers, was thoroughly searched during April, 1929. At one time we made net hauls forty-five miles offshore but found no eggs or larvae. During the early part of May the search was extended north to Eureka, and throughout the latter part of May and all of June the search was to the south. It was on this southern cruise that we finally met with success, for upon entering the Gulf of Santa Barbara eggs and larvae were found in considerable abundance. Unfortunately, the patrol boat *Albacore* which we were using had to return to patrol duty at the end of June and our work was interrupted so that we were unable to ascertain the actual limits of the spawning area. Therefore, during 1930 this aspect of our work will be continued.

Throughout the course of this investigation hauls for eggs and larvae were made with a hoop net twenty feet in length, constructed of strong

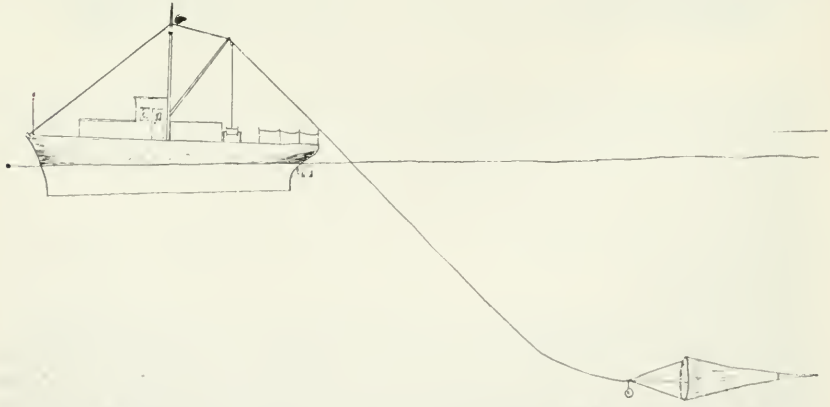


FIG. 36. Manner in which the egg and larva net was operated from the *Albacore*. Any depth could be fished, depending on the amount of cable played out and the amount of weight attached to the net. The net consisted of very small meshes, especially in the bag where No. "O" silk mesh was used. This captured eggs less than 1/25 of an inch in diameter.

cable cloth, with a silk bag of No. "0" mesh at the tip. This net was five feet in diameter at the opening, tapering down to three inches at the tip, into which a bottle was inserted to collect the material strained from the water. Hauls were made down to as deep as 50 fathoms for a set time of 15 minutes. This time limit did not permit the eggs and larvae to become crushed within the net; consequently, many perfect specimens were captured.

A sufficient amount of material was accumulated (210 eggs, 476 larvae) from which we could identify these young stages as those of sardines, and from which a complete series of stages in growth was obtained, from the egg to specimens approximately 35 millimeters in length which were readily identified as sardines. We offer at this time, therefore, a brief description of these eggs and larvae:

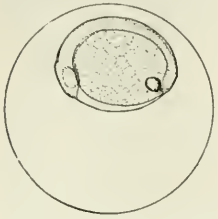


FIG. 37. A sardine egg in a late stage of development. Notice the large space lying between the yolk and the egg wall; the irregularly shaped segmentation of the yolk; the single oil globule in the hind part close to the tail. Drawn from preserved specimen by Rolf Bolin (1.9 mm).

1. The eggs are pelagic and float freely in the water from the surface down to at least 50 fathoms. (Not having sufficient cable, we were unable to fish any deeper than this level.)

2. The eggs are transparent while in the water and are not readily distinguished.

3. The eggs average 1.89 millimeters in diameter. (About 1/14 inch.)

4. The space between the yolk sac and the eggshell is very large. This is characteristic of the eggs of only a few species of fishes.

5. The yolk is about one-quarter the size of the entire egg and is divided into many irregularly-shaped segments.

6. Only one oil globule is present in the yolk. This lies in the hind region and averages 0.15 millimeters in diameter. (About 0.0167 inch.)

7. The larvae upon hatching are about 3.5 millimeters long. (About 1/7 inch.) The yolk sac and oil globule are still intact.

8. Characteristic pigment spots form along the ventral surface of the early larvae; prominent among these spots are those which appear directly behind the vent and on the lower rays of the caudal fin.

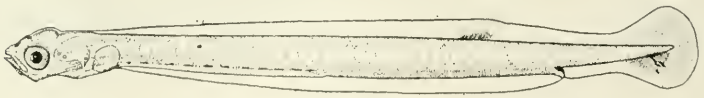


FIG. 38. A sardine larva in the premetamorphosed stage of development. Pigment spots are forming along the ventral surface. Typical pigments already appear behind the vent and on the lower rays of the caudal fin. The dorsal and caudal fins are just forming. The yolk sac has been absorbed and beeding has probably commenced. Drawn from preserved specimen by Rolf Bolin (10.5 mm).

9. The vent lies well toward the posterior end of the larvae.

10. Eggs and larvae were removed from water which ranged in temperature from 57 to 70 deg. Fahrenheit.

Acknowledgment.

We are greatly indebted to Mr. N. B. Scofield and Mr. H. B. Nidever of the California Bureau of Commercial Fisheries for their hearty support and timely suggestions in this investigation. We wish to thank the members of the State Fisheries Laboratory who have helped, especially Mr. W. L. Scofield and Miss Frances N. Clark, whose long experience in the study of the California sardine proved a great asset in the guidance of our work. Lastly, we wish to thank the entire crew of the patrol boat *Albacore:* Walter Engelke, captain; Erol Greenleaf, Roy Moseley and Ernest Schmidt. Their eagerness to help and their warm companionship made our many days at sea extremely pleasant.

REPORT ON THE RELATIVE MERITS AND DEMERITS OF PURSE SEINES VS. LAMPARA NETS IN THE TAKING OF SARDINES

By Paul Bonnot, Bureau of Commercial Fisheries
[With two photographs by the author]

During the Monterey sardine seasons of 1926–27 and 1927–28, two purse seiners were employed in the fishery in an experimental capacity. The boats were a success as a means of taking sardines under the local conditions. It was found necessary to develop a new method of unloading them, as they could not go under the cables used for unloading the lampara lighters. A suction hoist is used, its main feature being a high-speed centrifugal pump. The suction hoist is not very efficient, as it delivers the fish in a pounded condition and tears up a good many. The percentage of fish rendered unfit for canning by being torn and broken in the suction hoist will sometimes run as high as 50 per cent.

Because of the success of the first two purse seiners, more of them are being added to the Monterey sardine fleet. The lampara fishermen have entered complaint against the purse seiners, their chief premise being that the purse seines are much more destructive to the fish than the lampara net.

During January and February, 1929, I made a number of trips with the purse seiners, and also with lampara boats, studying their methods of fishing. The purse seiner *Agnes S* was used for the gathering of data for this report. The *Agnes S* is a new boat. She is 65 feet in length and powered with a 120-horsepower Atlas Imperial full Diesel engine. The hold has a capacity of 75 tons of fish, and 20 tons more can be carried on deck in good weather. The purse seine used is 180 fathoms in length and 30 fathoms deep. The smallest mesh of the webbing measures $1\frac{3}{4}$ inches.

Due to periodical scarcity of fish and stormy weather, only two trips on the purse seiner were productive of first-hand information regarding the fishing of this type of gear. The last trip was on February 12, 1929. The *Agnes* went on the beach at King's Beach on the night of the 13th and was towed to Oakland for minor repairs.

After the *Agnes* went ashore, I made several trips on one of the newer lampara boats, the *Umberto Nobile*. The *Umberto Nobile* is a documented boat 44 feet in length, powered with a 65-horsepower Diesel engine. She carries a lampara 200 fathoms in length and 40 fathoms deep. The lighter has a capacity of about 20 tons and the boat will carry a deckload of nearly as much more. One trip was made to Santa Cruz, where we obtained nothing. On another trip we took 40 tons of fish within a mile of shore just north of Point Pinos. The greater part of the fish landed at Monterey are taken within a five-mile radius.

I have gone into some detail in regard to the method of using the purse seine in this report, as I do not remember ever having seen it written up. The lampara has already been written up, so I have not made a detailed description of its use.* With minor differences the

*Methods of Sardine Fishery in Southern California, E. Higgins and H. B. Holmes, California Fish and Game, 7, 219–239, 1924. The Lampara Net, N. B. Scofield, California Fish and Game, 10, 66–70, 1924.

handling of both nets is the same, and this will apply also to the loading of the fish from the water to the boats and from the boats to the cannery hoists.

The basis for the present complaints against the purse seiners can, I think, be traced to the conservatism of the Italian lampara fishermen against any change of gear, a characteristic true of most fishermen, and to some extent to racial prejudice, the purse seine crews being for the most part Austrians.

METHOD OF FISHING WITH THE PURSE SEINE

(Monterey, January 27–28, 1929)

This trip was typical of several and gives an idea of the way in which the boats and net are handled.

I boarded the boat at Monterey at 4 p.m. and we left the mooring at 4.30 p.m. There was a slight south wind and the sea was smooth. We ran a course a little west of north, which put us abeam the cement works at Davenport about 9 p.m. Here we encountered small schools of fish. The water was full of phosphorescence and the fish were easily seen. The seine skiff was dropped a short distance astern with two men in it, attached by the necessary ropes to the purse seine. The boat proceeded slowly now, and after a short time encountered a larger school of fish, around which she began to circle. At the auspicious moment the captain yelled a word which sounded like "Pola" and the skiff was at once set free. The resulting drag on the net caused it to run out astern over the roller on the net table. The boat continued to circle, the distance being so nicely estimated that the skiff bumped the bow as the last of the net went out over the stern. The purse ropes were brought in, taken around the power winch, and for the next few minutes the inch and three-quarter line came in steadily, both ends being brought in at the same time. When the purse rings were on deck the lights were turned on. The purse seine when laid out encloses a circular area of

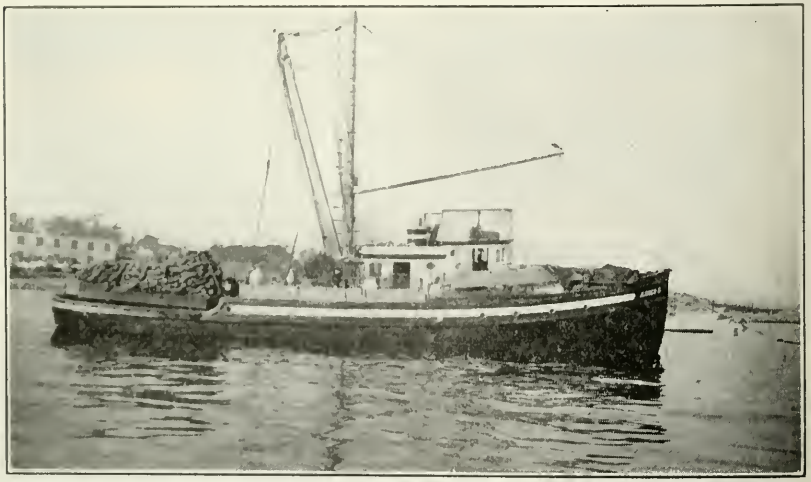


FIG. 39. The purse seiner *Agnes S.* unloading sardines at Monterey, California, February 13, 1929.

water, the corks on the surface, of course. The net hangs straight up and down. The purse rings hang from the lead line by short ropes. The purse rope acts as a draw string and brings the rings aboard, leaving the fish impounded in a net bag supported by the cork line and the boat. The whole operation, from the time the captain ordered the net laid out until the purse rings were on deck, was conducted in darkness and silence. The table was now turned at right angles to the boat, the roller being on the port side. The chain drive was connected up to the roller and the end of the net toward the stern of the boat was brought in slowly, until the impounded fish were confined in a small enough space to be worked with the brail.

The school of fish pursed up in the haul was disappointing. There were about 15 tons of small mackerel and enough small sardines to thoroughly foul the net. The sardines were about six inches in length and nearly all of them were gilled in the net, so that the crew was compelled to clean it of these gilled fish, a long and tedious job. The net was laid out at 9.30 p.m., and it was 4 a.m. before it was on the table and everything ready to start again. As soon as the captain found that the impounded fish were mackerel the boat was reversed, which pulled the net tight, from the bottom, sinking the cork line and releasing the fish, which departed at once, apparently none the worse.

After putting everything shipshape we ran north until we had the Pigeon Point light abeam. Here we ran into a school of fish which were jumping. They made an audible sound like the falling of heavy rain. The boat was stopped and we drifted until daylight, the fish jumping all about us. At 6 a.m. we laid out again. The same procedure was gone through with. This time the captain estimated that there were about 100 tons of fish in the net after the rings were on deck. While getting the net in, the fish sank part of the cork line, boiled over and departed like a herd of stampeded sheep. The captain estimated that 20 tons escaped in this way. His estimates were fairly accurate, as we loaded about 80 tons.

After the fish were confined in a small space, the cork line enclosing a circle of about 20 feet in diameter, the skiff was pulled around so that the enclosed circle lay between it and the boat. One man manipulates the brail from the skiff. The brail is hoisted from a block on the hoisting boom, the other end of the rope going down to the power winch. The operator in the skiff shoves the brail into the impounded fish by its long handle and, when he considers it has a load, yells "Riva," when it is lifted and swung inboard. The brail is a net bag hung from a round iron hoop. It has a wooden handle 8 to 10 feet long, and is raised by a three point suspension of ropes which connect with a tackle on the boom. The bottom is pursed together with a number of small rings through which a small chain runs. When the brail has been brought over the hold the man holding the purse string releases it and the fish drop out into the hold. The first fish drop about 10 or 12 feet. The fish are very lively and kick and struggle themselves out level so that no labor is necessary to level out the load. The struggles of the fish also tend to pack them solidly in the hold.

This set took from 6 a.m. until 2 p.m., when we started for Monterey. Being loaded, we ran more slowly than when coming out. We tied up to the hoist at Hoyden's cannery at 7.45 p.m. and started unloading at once. The last fish was delivered at 12.30 a.m.

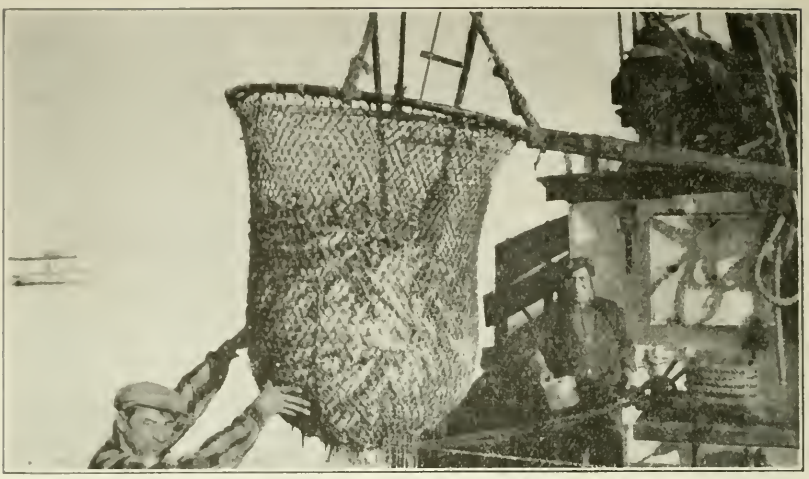


FIG. 40. A brail load of sardines being unloaded from the purse seiner *Agnes S.* at Monterey, California, February 13, 1929.

Time Synopsis of Purse Seine Trip to Pigeon Point

Leave Monterey	4.30 p.m.
Set at Davenport	9.30 p.m.
Net back on table	4.00 a.m.
Set at Pigeon Point	6.00 a.m.
Fish loaded and net aboard	2.00 p.m.
Arrive at loading hoist	7.45 p.m.
Last fish unloaded	12.30 a.m.

This load would exemplify the average distance range of a purse seiner at Monterey. The impounded fish which were taken at 6 a.m. were alive and in very good shape up until 2 p.m., when the last of them were loaded into the boat. The last ton or two in the net were, of course, dead, as the space into which they were confined was made gradually smaller and they were churned continually by the brail. From the time the fish were pursed (6 a.m.) until the last of them were delivered (12.30 a.m.) about 18 hours elapsed, but the only fish which were soft were those in the bottom of the boat. The suction hoist used at the Hoyden cannery is inadequate, having only a 6-inch intake, and the four hours needed to unload these fish could be cut in half with a 12- or 14-inch intake.

THE PURSE SEINE AND CONSERVATION OF FISH

The captain and crew of the purse seiner seemed to be able to estimate very accurately, not only the fish in the net but also the various schools through which the boat passes. They will not set out the net for a school which they think contains less than 70 or 80 tons. The setting of the net and the subsequent labor of taking it in is tremendous, and being able to estimate so closely it does not seem reasonable to believe that they would catch and purse up vast quantities of fish knowing that they can load only so many tons. In case a large school was pursed the surplus fish could be gotten rid of by the simple expedient of sinking the cork line and allowing the required amount to escape.

A good deal of erroneous information is given out by the purse seine fishermen themselves to impress the lampara fishermen. In the case of the trip which I have cited several Italian fishermen informed me that the purse seiner had taken 300 tons of fish. Their information, they said, was from the purse seine crew. Considerable personal feeling enters into the matter between the purse seiner and the lampara fishermen, the main cause being, I think, that with a more extended range the purse seiner obtains fish when the lampara boats get nothing, due to weather or distance.

On the other hand, knowing what my object was in going fishing with them, the purse seine crew would naturally not do anything before me that would jeopardize their position in the present fishery, and would therefore carefully refrain from any nefarious practices. Several disinterested individuals, of undoubted veracity, have told me that they have seen the purse seiners purse up large quantities of fish, take on their limit and leave the sea covered with dead fish. One of these men worked with the purse seiners in Monterey Bay when they were first used there. He is of the opinion that with a more experienced crew this waste might have been eliminated.

If purse seiners should replace the lampara boats at Monterey a great many fishermen would not be able to fish. A purse seiner can handle larger quantities of fish from greater distances, and therefore the number of boats would necessarily be reduced with the present number of canneries. A purse seiner operates with a crew of nine men against an average lampara crew of thirteen.

A COMPARISON OF THE PURSE SEINE AND LAMPARA NETS

The purse seine and lampara nets are very much the same thing from a standpoint of wasteful methods of fishing. Both nets impound the fish in a more or less confined space, and if too tightly packed the fish die. The capacity of both nets is in excess of the accessory gear (boats and lighters), and if judgment is not used a great deal more fish can be impounded than can be loaded, thus leaving fish which have been bruised and pounded by the brails to die.

The purse seine and its accessory equipment are comparatively large and expensive, the net costing around $5,000 to $6,000 and the boat $20,000 to $25,000. Because of its size the purse seine is handled slowly, even with the provided power. The crew is composed of nine men. The net is capable of handling large quantities of fish, and the large boat makes fishing possible at some distance from the point of delivery.

The lampara net with its equipment is a smaller unit of gear. The net costs about $500 to $600 and the average boat from $6,000 to $8,000. The net is handled entirely by man power, the average crew being composed of thirteen men. The net being comparatively small is set for small schools of fish when large schools are wanting. The impounding and brailing of the fish are carried on in much the same manner as the purse seine, the only difference being that the lampara can handle about 60 tons of fish, while the purse seine can impound up to 200 tons.

SUMMARY

From personal observation and information which I have gathered I am of the opinion that the purse seine *can* be used in the sardine

fishery without loss of fish either by the fishermen or from the element of time which enters into the matter when the fish are at some distance from the utilization point.

The fishermen have wasted fish in the past, perhaps from inexperience and carelessness, but the crew is culpable, and not the gear. When handled properly and with due regard to conserving the fish, the purse seine will compare favorably with any unit of gear which handles fish in large quantities.

THE CALIFORNIA WHITEBAIT FISHERY

By Paul Bonnot

[With four photographs and one drawing by the author]

Nearly everyone with a taste for fish is familiar with "whitebait," but very few have any idea as to what it is, where it comes from, or the methods of obtaining it. Whitebait as a trade name has been in use a long time. Whitebait was taken in the Thames River and sold in England about 1800. Some question was raised at the time as to whether or not it was the young of valuable fishes, especially the shad. A Dutch zoologist in 1806 determined that it was not young shad, and the fishermen, of course, maintained that it was a small distinct species. Subsequent inquiry into the matter has resulted in establishing the Thames whitebait as the young of the herring and sprat. In various parts of the world young fishes are taken and marketed. In English-speaking countries such fishes are indiscrimi-

Fig. 41. Five species of fish in a random handfull taken near Fort Point, San Francisco Bay, California, October 23, 1929. They are jack smelt (*Atherinopsis californiensis*), surf smelt (*Hypomesus pretiosus*), panzarotti (*Atherinopsis affinis affinis*), anchovy (*Engraulis mordax namus*) and herring (*Elupea pallasii*).

nately called whitebait. On the east coast of the United States whitebait is used to designate the smelts found in both fresh and salt water. Although primarily applied to adult smelts and silver sides, the whitebait of the Pacific Coast may be any small or young fish. Young sardines *(Sardinia caeruleus)*, anchovies *(Engraulis mordax)* and herring *(Clupea pallasii)* will be found in the markets as whitebait. The Pacific Coast smelts and their relations are worked over ever so often by the taxonomists, who bring out new species periodically, and it is rather difficult to say just which fishes are represented in the commercial whitebait. Lockington (1880) says: "There are thus four species of *Microstomatidae* on the Pacific Coast, United States, viz., *Thaleichthys pacificus*, Hypomesus *olidus, Osmerus thaleichthys* and *Osmerus attenuatus.* The first of these does not occur in the markets of San Francisco. * * * The other three are brought into the markets in the fresh state."

Hubbs (1925) lists six species of "smelts" which range from central California northward, viz., *Allosmerus attenuatus, Thaleichthys pacificus, Spirinchus starksi, Spirinchus thaleichthys, Hypomesus olidus* and *Hypomesus pretiosus.* "The surf smelts *Allosmerus attenuatus* and *Spirinchus starksi* make up the larger portion of the commercial whitebait." Most of the other species will no doubt be found among the whitebait in varying numbers.

The common name smelt is used in California to designate several species of small fishes. Some of these are true smelts and some are not.

The true smelts of the family *Argentinidae* may be distinguished by the presence of an adipose fin, an appendage which shows the close relationship to the salmonoid fishes. "In fact the true smelts may be considered degenerate *Salmonidae*, smaller and weaker than the trout, but resembling them in all respects except in the form of the stomach." The true smelts range, on the California coast, from San Francisco

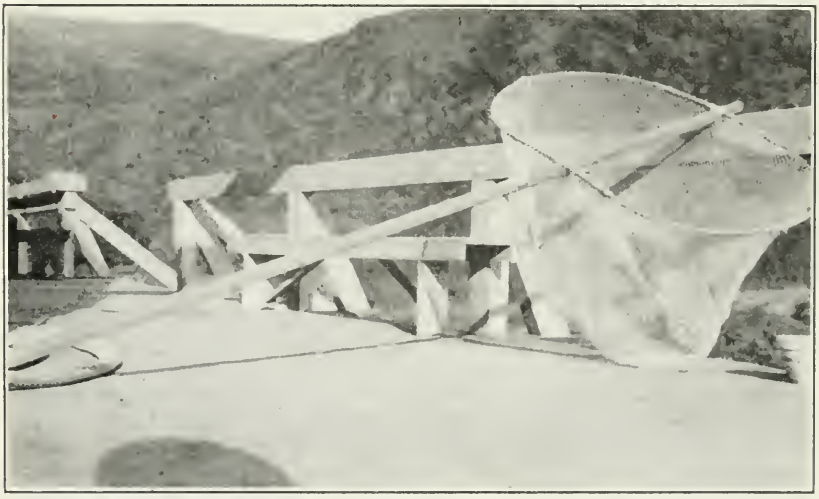


FIG. 42. A surf net for taking whitebait. Photograph May 28, 1929, at the mouth of the Russian River, California.

northward, one species only extending its range to Monterey. The surf smelts (Hypomesus) and the smelts (Osmerus) spawn in the surf. The candle fish (Thaleichthys) runs into fresh water to spawn and, like the salmon, dies afterwards.

The silver sides (Atherinidae) are not true smelts. These fishes lack the adipose fin and are closely related to the mullets. Along the lateral line there is a silvery band of color sometimes underlaid with a black line. They are carnivorous fishes traveling in large schools and, some of them at least, spawn in the surf. Three species are important in California. These are the jacksmelt (Atherinopsis), the panzarotti (Atherinops) and the grunion (Leuresthes).

The systematic position of the whitebait fishes:*

Argentinidae. (Smelts.)
- Osmerus. Linn. Syst. Nat., ed. X, 310, 1758.
  - Osmerus thaleichthys. Ayres, Proc. Cal. Ac. Sci., 1860, 62. (Smelt.)
  - Osmerus attenuatus. Lockington, Proc. U. S. Nat. Mus. 1880, 66. (Smelt.)
- Hypomesus. Gill, Proc. Ac. Nat. Sci. Phila., 1862, 168.
  - Hypomesus pretiosus. Girard, Proc. Ac. Nat. Sci. Phila. 1884, 155. (Surf smelt.)
  - Hypomesus olidus. Pallas, Zoogr. Rosso-Asiat., III. 391, 1811. (Surf smelt.)
- Thaleichthys. Girard, U. S. Pac. R. R. Surv., Fishes, 325, 1858.
  - Thaleichthys pacificus. Richardson, Fauna Bor. Am. III. 226, 1836. (Candle fish.)

Atherinidae. (Silversides.)
- Atherinopsis. Girard, Proc. Ac. Nat. Sci. Phila. 1854, 134.
  - Atherinopsis californiensis. Girard, Proc. Ac. Nat. Sci. Phila. 1854, 135. (Jack smelt.)
- Atherinops. Steindachner, Icth. Beitr., III, 61, 1875.
  - Atherinops affinis. Ayres, Proc. Cal. Ac. Sci. 1860, 73. (Panzarotti.)
- Leuresthes. Jordan and Gilbert, Proc. U. S. Nat. Mus. 1880. 29.
  - Leuresthes tenuis. Ayres, Proc. Cal. Ac. Sci. 1860, 76. (Grunion.)

The spawning habits of the whitebait fishes make it possible to take them in large numbers. When the spawning period comes, during the summer and fall, different species spawning at different times, they resort in immense numbers to clear sandy beaches. Here they work along the edge of the white water, sometimes being stranded between breakers. The eggs and milt are liberated in the edge of the foaming rollers. The water is continually churning, thus insuring contact between the eggs and sperm. So numerous are the fish at this time that they cause the water to boil and eddy, and so great is the amount of their spawn that the water near the beach has a "sticky" feel, is slightly milky in appearance and possesses a distinct odor similar to that of freshly cut cucumbers.

The candle fish *(Thaleichthys)* is very oily and when dried will burn up completely if ignited. Smoked candle fish are golden yellow in color and are much esteemed by the northern Indians. Few candle fish are sold fresh by the Indians. In Oregon and Washington candle fish are canned and smoked by several concerns on a commercial basis. The surf smelts are too soft and delicate to stand any process of preserving and are sold fresh, although some may be hard salted.

*From a check list of the fishes and fish-like vertebrates of North and Middle America, Jordan and Evermann. Report, U. S. Comm. Fisheries, 1895, App. 5, pp. 207–584.

FIG. 43. An Indian surf net used for taking whitebait. Photograph May 31, 1929, at mouth of Mad River, California.

As the smelts and their allies range from central California to Alaska they have always been one of the sources of food supply for the Indian inhabitants of this region. The fishing methods and gear evolved by the Indians to take the whitebait are still in use today. The surf smelts, which constitute the greater part of the present commercial whitebait, are taken by the Indians with the surf nets invented by their ancestors. Before the advent of the white man the Indians made the webbing for their nets from the fiber of the stinging nettle *(Urtica dioica)*. The webbing used now is the ordinary cotton or linen twine. The nets in use today are of several sizes and shapes, depending on their uses, and in some cases on the tribe of Indians who make them. The nets used in California are of three types. In the district about the mouth of the Russian River the net is built in the form of a large dip net except that the hoop instead of being round is oval, being flattened at right angles to the pole handle. See figure 42. This type of net is now made by the white residents of the Russian River district and rented to vacationists who wish to catch their own fish. Another modification of the dip net evolved by the Indians is obtained by lashing two poles together to form a curved ring at one end, to support the net, and bringing the other ends together as a handhold. See figure 44. The largest and most widely used net is a departure from the dip net type. A reference to figure 45 will give a much better idea of this type of net than a written description. In using these nets the operator wades into the surf up to the waist and handles the net as if it were a scoop shovel. The bag of the net is held in the hand which holds the butts of the poles, so that a small quantity of fish may be imprisoned while the net is in operation. The fishing is done either by night or day, as some of the fish spawn during the day and others during the night. The Indians distinguish these different fishes as "dayfish" and "night-fish." At times a single thrust of the surf net will capture so many fish

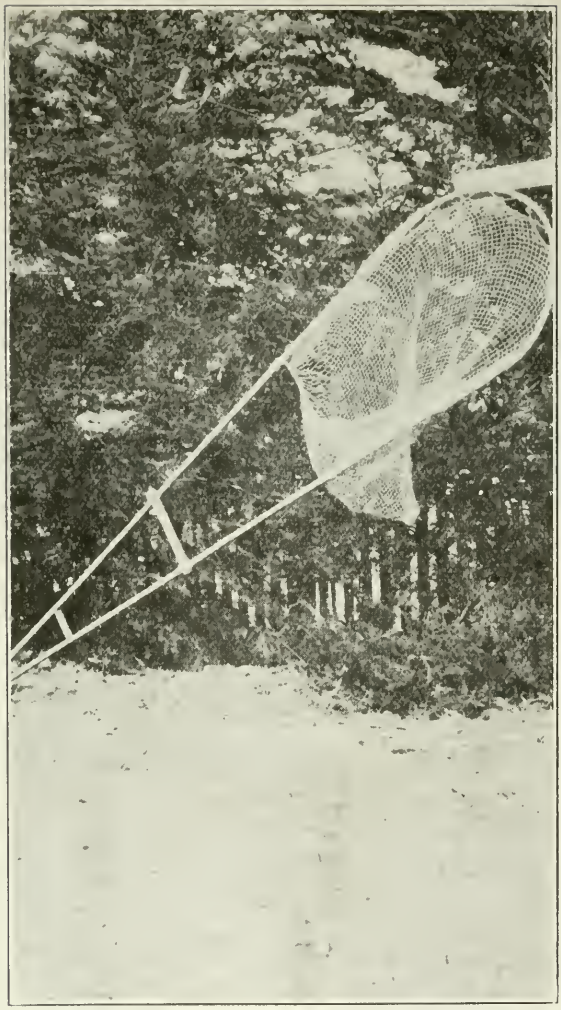


FIG. 44. A type of small dip net made by the Klamath Indians and used for taking surf fishes. Photograph Sept. 12, 1929, at Requa, California.

that the operator must go ashore and dump it. Any one school of fish does not take very long to spawn and depart. A school will generally work along a given beach for only a couple of hours. During that time the fishermen work fast and pile up large heaps of the fish on the sand or put them directly into sacks. During the last few years tourists and campers in northern California have learned to catch the surf smelts. Some of them have made nets patterned after the Indian nets. Others have constructed all manner of dip nets, and during a run of fish, inspired by the rush and excitement, they will sometimes jump into the water and catch fish with their hands.

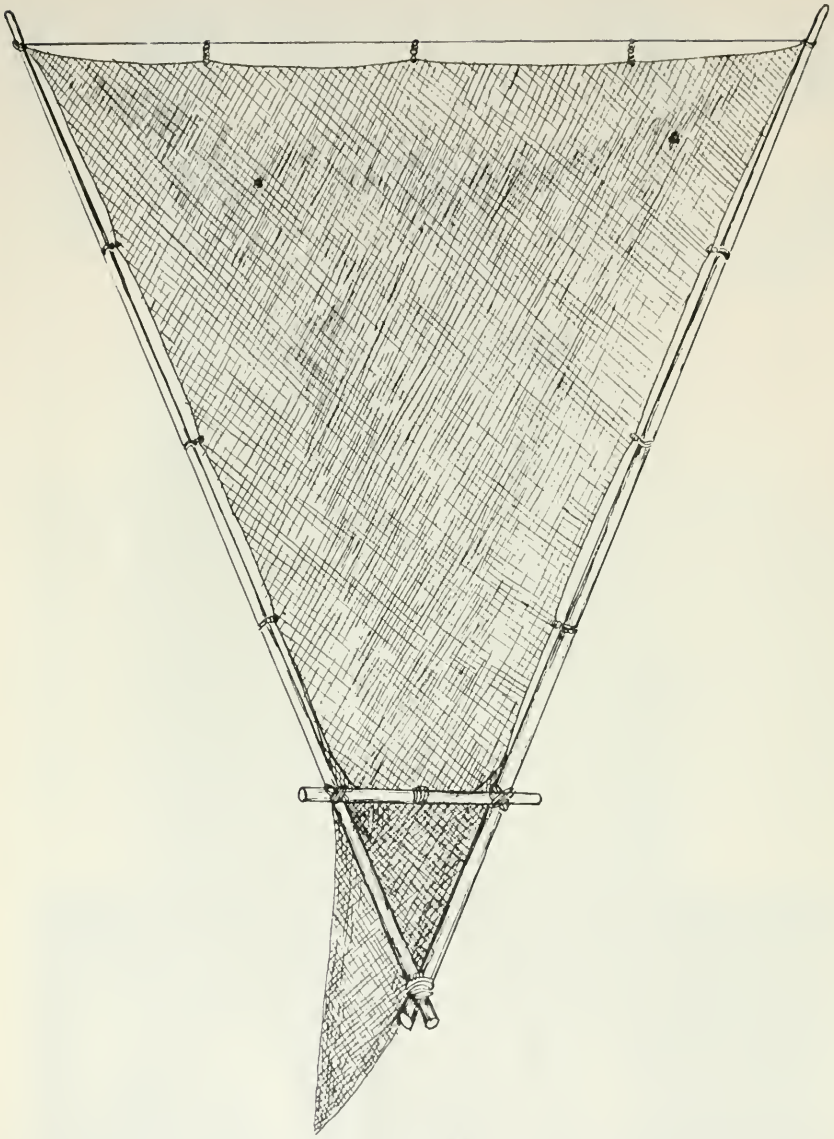


FIG. 45. Surf net for taking surf fish (whitebait). The poles are 7 feet long and the net 6 feet wide at the top. The back of the net from cross bar to point is 24 inches. Mesh of webbing ¾ inch. Sketch August, 1926, Trinidad, California.

In the old days the Indians dried and smoked the surf fishes for winter use. Those who did not live on the coast moved down and camped on the beaches during the runs. They built rude shelters of driftwood and cured their fish on the spot. While some of the fish are still cured and used by the Indians in northern California, most of the catch is sold to the wholesale fish houses and the Indians get their winter fish from cans.

Whitebait Catch Figures—Northern California*

	Jan., Feb., Mar.	Apr., May, June	July, Aug., Sept.	Oct., Nov., Dec.	Totals
1924	4,222	58,552	55,614	3,386	111,774
1925	1,576	33,315	33,259	2,818	70,968
1926	7,215	34,762	43,425	155	85,557
1927	19,582	85,755	21,439	7,373	134,149
1928	9,388	93,428	31,967	1,303	135,186

	Del Norte, Humboldt	Mendocino, Sonora	Marin	San Mateo, San Francisco
1924	53,461	172	3,715	62,096
1925	38,017	---	4,845	28,106
1926	73,242	---	4,232	7,689
1927	101,272	---	313	30,955
1928	100,236	16,470	232	14,388

*Compiled by the Bureau of Commercial Fisheries.

A SHOCKING FISH TALE

Electrocuted Tuna Easily Landed

By Coburn F. Maddox
[With two photographs by the author]

In 1920 Captain Guy Silva was cruising in his boat, the *Alice*, off the Soccoro Islands, about 250 miles south of Cape San Lucas. They were not having very good luck, but finally ran into some big Allison's yellowfin tuna weighing between two hundred and three hundred pounds each, and were working hard to land these big fellows, it took four or five men to bring these big yellowfin tunas to gaff. The idea occurred to Captain Silva at this time to try electrocuting these big tunas so they could be handled by fewer men. He also had discovered that local tunas as well as the Allison's would not take bait on the heavy gear and large hooks necessary to bring them aboard the boat. Being somewhat of an electrician Captain Silva figured out he did not have enough voltage on the boat *Alice* to successfully kill or stun so large a fish, so he had to let the experiment go for a while, but when he launched his new boat, the *Lois S*, in 1926, he had his first chance to

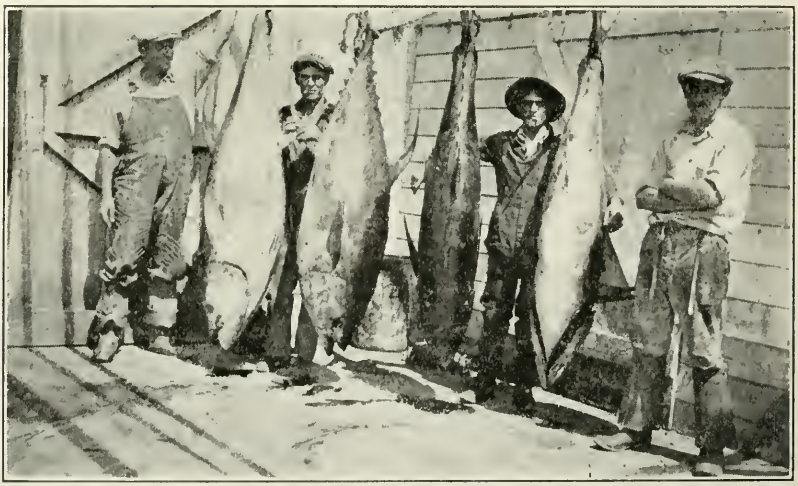


Fig. 46. Large tuna secured by new method of electrocuting fish to hasten capture.

FIG. 47. Landing a large tuna taken by the new method developed at San Diego, California.

try out the idea that had occurred to him years before, and which he had carefully worked out in the meantime. His first victim was a 150-pound bull shark which was shocked and stunned so he was easily gotten aboard, but the current of electricity did not kill him. This time a current of 110 volts was run off batteries, and one of the crew while landing the shark must have hit the hook as he gaffed it, and was severely shocked. This accident stopped the fishing along this electric line of operations for a month or so, but the captain had not given up the idea and worked on it and finally perfected the original gear so as to make it practically "foolproof." Even when assured there was no danger the crew was loath to operate the electric gear, saying, "Look what it did to the fish." Finally a catch with the new gear was safely

demonstrated and as the skeptics were convinced that all danger had been eliminated the fishermen crew then took hold and fished with most gratifying results, for it was found that two men could easily handle a 250- or 300-pound tuna, while it had required at least four men by the old method of bringing them to gaff; the whole operation taking only 50 seconds. One load of these Allison's tunas taken in this way weighed seven fish to the ton, some of the said load being shown in the accompanying pictures, with members of the crew standing beside them to give the reader a better idea of the size of the tuna fishes caught by this electric system. The lone tuna in the picture with W. Ashlock, a member of the crew of the *Lois S,* was seven feet long and weighed 328 pounds, being the largest tuna caught with this small hook electric gear, though a 500-pound shark was the largest fish secured in this way.

The accompanying sketch and explanation will, I hope, make it clear to the reader just how this electric gear is constructed and operated:

Voltage required 120 volts direct current off a generator or battery. The generator must have 3 k.w. (kilowatts) capacity as it takes at least 30 amperes 50 seconds to kill a big tuna (though ordinarily they are just stunned when brought to gaff). The fourteen-foot pole is of ordinary bamboo about two inches through at the butt end with a metal ring on the tip end connected to positive side of 120-volt system or circuit through an insulated wire "A–B." The negative side of the system being grounded in the water "W." When a fish takes the bait on hook "C" he pulls the contact ring "X" to the metal contact ring "Y" by means of cotton line "T–D," which sends a direct current via flexible wire "K" to contact ring "Z" and on to hook "C," which administers the coup de grace to the tuna. It was found that if the current was run directly from the battery to the hook that two bad results would follow: first it killed the live bait on the hook and second

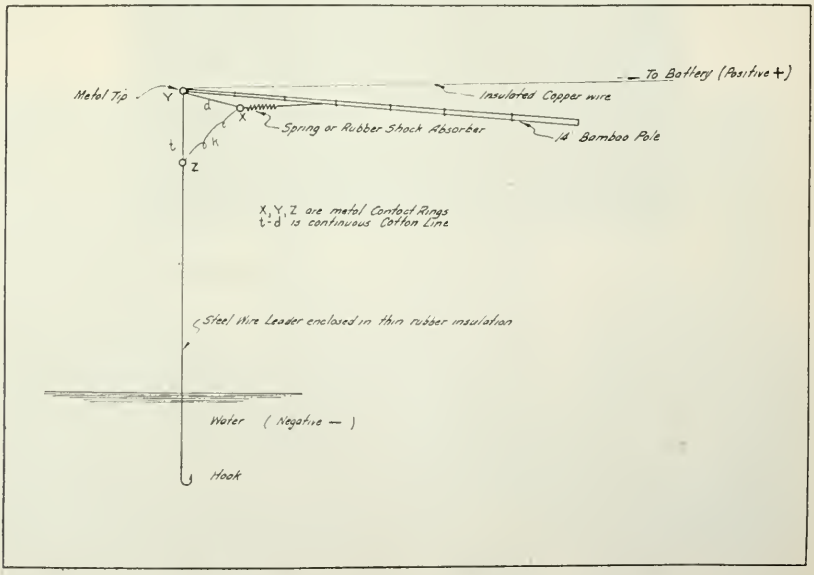


FIG. 48. Graph showing method of employing electricity in the capture of large food fishes.

caused the hook itself to oxidize, rendering it useless after the current had been applied for more than fifteen minutes at a time when in the water. This is the reason for the switching device on the tip end of the pole.

This system was also used by Captain Seeley of the boat *Nuchum* to catch swordfish, but due to the difference in the method of catching the swordfish, that is by harpooning them, it was found that it was not practical as it resulted in spoiling the white meat of the swordfish by burning and discoloring it for some distance at and around the wound caused by the entrance of the harpoon into the swordfish due, no doubt, to the great amount of surface charged with electricity in the harpoon.

This method is being used regularly by Captain Silva and I would not be surprised at any new electrical devices he may invent or develop, as he has already invented a magneto, an ignition system for internal combustion engines, and has received patents for a number of electrical devices.

SALT-WATER PERCH IN THE SAN PEDRO WHOLESALE FISH MARKETS*

By Frances N. Clark

Because of their minor importance, many species of commercial fishes of California are entirely neglected in the scientific studies carried on by the Bureau of Commercial Fisheries of the Division of Fish and Game. Due to the necessity of concentrating these studies on the major fisheries of the state, this neglect, although unfortunate, is unavoidable. While pursuing these researches, however, many scattered bits of information are gathered concerning the lesser commercial fisheries. All such facts, if made available, will eventually form valuable contributions to the total sum of our knowledge of the commercial fisheries.

Such a minor fishery is that for salt-water perch, family Embiotocidae. These fishes are known variously as pogie, porgee, shiner, surf-fish, surf perch, viviparous perch, perch, and salt-water perch. Since these fishes are very different from the true perches, family Percidae, found only in fresh water, the name salt-water perch is here used as it distinguishes this group from the true perches, and avoids confusion with certain smelts, members of the family Osmeridae, also called surf fish. In addition to their commercial use, the salt-water perch are popular fishes with the anglers of the state, who fish for them from the rocks, and from the beaches, casting their line out into the surf. Because of their importance as angling fishes, these species are closed to commercial fishing from May 1 to July 15 of each year.

Much confusion exists among the common names of the individual species of Embiotocidae, due partly to the local application of these common names and partly to the difficulty experienced by amateurs in distinguishing between species. Because of the inaccurate application of these common names, in the catch records gathered by the Bureau of Commercial Fisheries, all species of salt-water perch are listed under the name perch. The first step, therefore, in securing information about the salt-water perch in the commercial fisheries of California, is to ascertain the relative importance of the different species in the catch.

* Contribution No. 89 from the California State Fisheries Laboratory, February, 1930.

Such an estimate for the Los Angeles region was the purpose of this study. The data here used were secured incidentally during visits made, in the interest of major scientific studies, to the San Pedro wholesale fish markets. The work was carried on during December, 1928, and for the entire year of 1929. With a few exceptions, the markets were visited twice weekly, and an estimate made of the percentage of each species of salt-water perch seen. The procedure was as follows: Fish are delivered to the markets in boxes. The number of pounds of fish in a box was ascertained from the dealer, fish selected at random were counted out and the number of fish of each species recorded. Estimates for each box were based on from twenty to forty fish, with thirty the usual number. These numbers were converted into percentages and the percentage of each species in a box of salt-water perch thus determined. To ascertain the percentage of each species for all the fish observed, the percentages for each box were multiplied by the number of pounds of fish in the box and these weighted percentages summed. To secure the proportions for a day the weighted percentages were summed for the day and divided by the total number of pounds observed on one day; for a month, the weighted percentages were summed for the month and divided by the number of pounds observed in a month; and the proportions for a year were secured by summing the weighted percentages for the entire year and dividing by the total number of pounds observed in the year. The results of these calculations are given in Table 1. Approximately 13 per cent of the entire surf fish catch of Los Angeles County, for the thirteen-month interval of the study, passed under observation.

TABLE 1

Percentage of each species in the commercial catch of salt-water perch delivered to the San Pedro fish markets

Species	1928	1929									
	Dec.	Jan.	Feb.	Mar.	Apr.	Aug.	Sept.	Oct.	Nov.	Dec.	10 mo.
Phanerodon furcatus, white perch	48.6	86.4	84.8	90.8	88.4	61.0	50.2	34.7	79.6	73.8	81.97
Hyperprosopon argenteum, wall-eyed perch	46.8	13.2	14.3	8.7	10.7	6.2	34.7	64.2	19.7	21.6	14.05
Rhacochilus toxotes, rubberlip	1.4	-------	0.9	0.4	-------	16.0	0.7	0.2	-------	-------	1.38
Damalichthys vacca, fork-tail perch	-------	-------	-------	-------	0.5	7.5	2.7	0.6	0.7	2.0	0.89
Embiotoca jacksoni, black perch	3.2	-------	-------	0.1	0.1	-------	4.2	-------	-------	-------	0.37
Amphistichus argenteus barred perch	-------	-------	-------	-------	-------	-------	-------	0.3	-------	2.0	0.04
Taeniotoca lateralis, striped perch	-------	-------	-------	-------	-------	0.4	1.2	-------	-------	-------	0.11
Hypsurus caryi, rainbow perch	-------	-------	-------	-------	-------	8.9	6.3	-------	-------	-------	1.06
Hyperprosopon agassizi	-------	0.4	-------	-------	-------	-------	-------	-------	-------	-------	0.04
Cymatogaster aggregatus	-------	-------	-------	-------	0.3	-------	-------	-------	-------	0.6	0.09

Of the fifteen species of salt-water perch recorded from the waters of southern California, ten species were found in the commercial catch during 1929. One species, *Hyperprosopon agassizi,* also termed *Tocichthys ellipticus,* has apparently not been recorded previously, south of Santa Barbara. Two of these fish were found in the San Pedro markets on January 31, 1929. This would constitute a new southern record for this species were it not for the fact that boats occasionally make

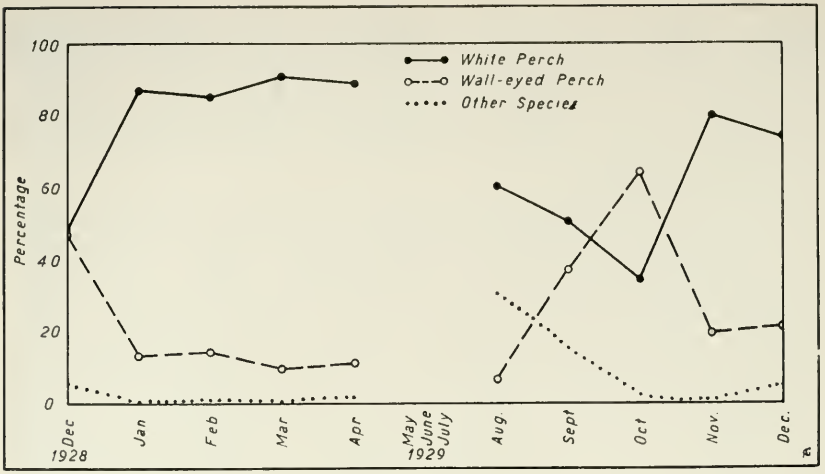


FIG. 49. Percentages by months of white perch and of wall-eyed perch in the commercial catch of salt-water perch delivered to the San Pedro fish markets.

deliveries to the San Pedro markets of fish caught off Santa Barbara. While such deliveries consist almost exclusively of flat fish, the possibility exists that these salt-water perch may have come from the Santa Barbara region.

The percentages of the different species of Embiotocidae comprised in the commercial catch of Los Angeles County are shown for December, 1928, and nine months of 1929, in Table 1 and Figure 49. Because of the closed season from May 1 to July 15, no fish were observed in the markets during May, June and July. The major portion of the catch consisted of two species, the white perch and the wall-eyed perch, and of these two, the white perch far exceeded the wall-eyed. For the thirteen months, the white perch constituted practically 82 per cent of the entire catch. For the species other than the white and wall-eyed

FIG. 50. Monthly catch in pounds of white perch and of wall-eyed perch delivered to the San Pedro fish markets.

perch, the greatest percentages were taken in August and September. During August, the rubberlip comprised 16.0 per cent of the catch, the fork-tail perch, 7.5 per cent, and the rainbow perch 8.9 per cent. In September, the rubberlip formed less than 1 per cent, the fork-tail, 2.7 per cent, and the rainbow, 6.3 per cent. For the other months the percentage of species other than the white and wall-eyed perch was practically negligible.

To determine the number of pounds of each species brought into San Pedro each month, the monthly deliveries for Los Angeles County were divided on the basis of the percentages of Table 1. These results are shown in Figure 50. The number of pounds of wall-eyed perch was relatively constant throughout the year, but the poundage of white perch showed a decided seasonal fluctuation. By far the largest quantities were taken in March and April. Because of the closed season, no fish were taken in May and June. By August, the white perch catch had dropped to less than that for January and February, a minimum was reached in October, which was followed by a slight rise in November and December. August and September were the only months in

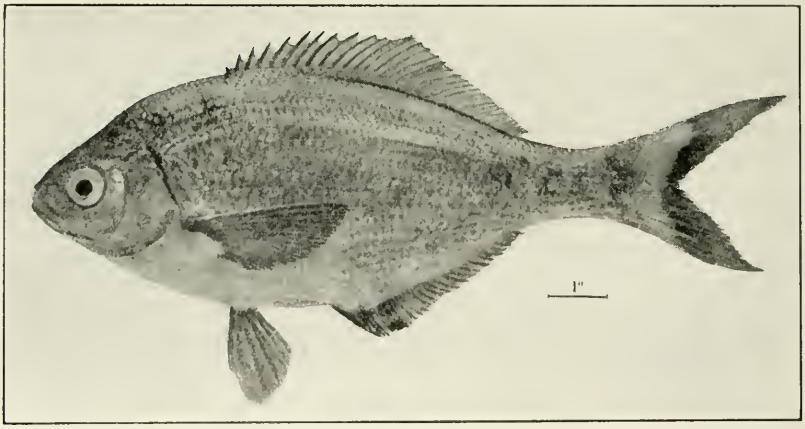


FIG. 51. White perch, *phanerodon furcatus*.

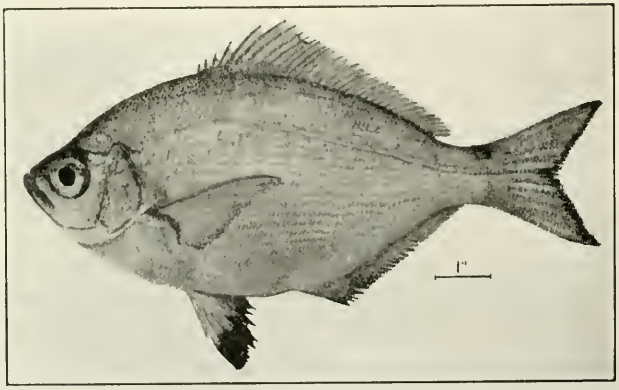


FIG. 52. Wall-eyed perch, *Hyperprosopon argenteum*.

which the miscellaneous species figured in the commercial catch. Seasonal fluctuations in the total catch of salt-water perch were the result, therefore, of fluctuations in the catch of white perch.

In the course of this study, a few observations were made on the breeding season of the Embiotocidae. Since these fish are viviparous, giving birth to live young, the dates were noted on which females were found with young easily extruded by a slight pressure on the body. The white perch were found in such a condition during late February, March and April; the wall-eyed perch, during March and the first half of April; the rubberlip, in late February and March; and the fork-tail, on one day in March. During late August and early September, the rainbow perch were found with young. The largest catches of white perch occurred during the breeding season, and it is probable that the closed season of May and June affords considerable protection to these fish as many individuals were in a breeding condition at the end of April. The breeding season apparently had little effect on the size of the catch of wall-eyed perch or of the rubberlip, for the wall-eyed catch was relatively constant throughout the year, and in August when the catch of rubberlip was greatest, no individuals were seen with young. On the other hand, no rainbow perch were observed except in August and September when several individuals were bearing young.

The results of this brief study of the salt-water perch delivered to the San Pedro fish markets showed that the catch was maintained chiefly by the white perch, comprising approximately 82 per cent of the total. The second most important species was the wall-eyed perch, which formed 14 per cent of the catch. The remaining 4 per cent consisted of eight different species. The number of pounds of white perch delivered fluctuated during the year with a maximum in March and April and a minimum in October. This fluctuation was reflected in the variations of the total salt-water perch catch, which followed very closely the changes in the white perch catch.

THE LILY-IRON RETURNS TO MONTEREY BAY

Shark Fishing Recommences on a Harpoon Basis *

By Geo. Roger Chute

Monterey, old whaling station, is likely to become Monterey, the shark port. Where the cachelot was once out-drawn, and full blubber-pots bubbled with body-oil tried from minced "horse-pieces," and where sweating Portuguese rolled greasy barrels to the water's edge, there now, in these more modern times, we may presently see arise specialized reduction and by-product institutions designed for a new but different oil trade.

Of course, the whales are gone. Man with his customary rapacity slew the majority of these a half generation past, and one can no longer stand on China Point and count a dozen or twenty spouts, as often could be done twenty-five years ago. The long files of inshore "grays" and "humpies," that in pregold days furnished whatever excitement there was to stir the drowsiness of the adobe Monterey pueblo, have vanished. Individual sulphur bottoms and sperm whales that used to

* Contribution No. 90 from the California State Fisheries Laboratory, February, 1930.

parade around the harbor during the season of sardine abundance, as well as in times of storm, have become fewer and fewer until now the appearance of some last Mohican of the Cetacean tribe occasions as much comment and discussion among seaside watchers and bay-town papers as though Fenimore Cooper's own Chingachgook and Uncus were to stalk down Broad and Wall streets, buckskin-clad and in paint. Let the truth be told: They all have been boiled; their fats and tissues have been reduced to liquid oil; the Staten Island (New York) tanks of Procter and Gamble have received this contribution from the Pacific and added it to the millions of that firm's accumulated wealth by the altogether primary process of converting the oil into numerous merchantable products, not the least of which is Ivory soap, esteemed for milady's bath.

So the past is dead. Let us turn the page to a new chapter.

Ancient Residents.

A sensationalist would have a discouraging time of it, trying to stir up excitement around Monterey with the announcement of the discovery of large schools of giant sharks in the bay. Everyone has known the fact for years. Nineteenth century whalemen found it out, and are reputed even to have practised a little, and had some sport during dull days, with the pot-bellied, hideous-looking fish. Then, in later times, Chinese came to angle for such of them as could be landed on baited hooks having chain leaders. During the last two decades the resource has been almost forgotten.

Almost, but not quite. Occasionally the big brutes blunder into some fisherman's way, and by the havoc that they make with his tackle and gear, impress upon him a painful reminder of continued presence. Fortunately, as a general thing they frequent a portion of the bight not visited by sardine netters, but the usual good luck of the seiners is

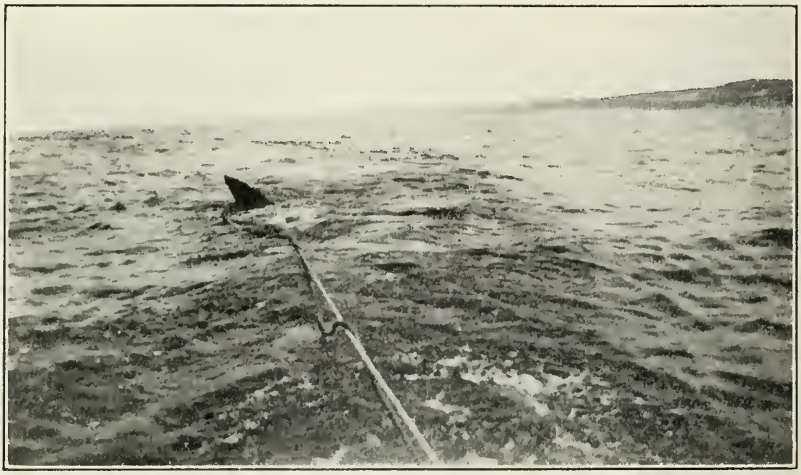


FIG. 53. Close along the beach, especially between Moss Landing and Seaside, schools of sharks can be seen finning almost any sunny day. A Nantucket lily-iron and ¾-inch manila line are used in the harpooning, and after the fish has been killed, a sliding bowline is slipped over the flukes and the flabby giant towed ignominously homeward, wrong end first. Photograph by Gilkey 1929.

punctuated here and there by disastrous encounters. Periodically they purse up one of these creatures. The fisherman's chastisement resulting from this sort of happening impresses a never-to-be-forgotten lesson —the costly tuition of that universal pedagog, Experience.

All Is Not Fish That Gets Into the Net.

"I remember of seeing a shark caught in a lampara in 1928," says Milton Lindner, one of the scientific staff of the Commercial Fisheries Department, who was stationed at Monterey for several years. "The Italians of the crew were making a tremendous racket while excitedly and ineffectively endeavoring to get a rope noose around the thing's tail. The shark was rolling back and forth alongside the boat and finally wore his way out of the net and escaped, for the men had nothing with which to kill him. He was half as big as their vessel."

To get a shark into a sardine seine is to depreciate the net's value immediately. Thousands of needle-like spines that protrude from the skin of the animal cut away the twine and so weaken the whole fabric that after one or two later usings it suddenly falls into tatters wherever the lacerating shagreen of the wallowing fish's hide came in contact with the cotton. Not seeming to appreciate that it is nothing more than the abrasive action of the rasping sides of the shark that ruins their webbing, many seiners speak of the damage that is done to gear as attributable to the "slime" of the baskers, which they seem to think rots or dissolves the mesh just as acid or lye might do.

"I was one night aboard a lampara boat that had already set on fish when a shark was discovered lying in the area surrounded," says Lindner. "The crew then made no effort to close the gear, but instead hauled back one of the wings so that the way would be made easy for the escape of the shark. When these big creatures are known to be about the fishermen will not set their gear."

The destructiveness of the baskers is well illustrated by an instance in which a tuna seiner was concerned. During October of 1929, while fishing off Cape San Lucas, Mexico, Captain Jack Berntsen, then master of the purse boat *Mabel*, by perverse fate cast his net around the very spot where one of these animals was feeding, or lying asleep, apart from his fellows. After a half day of heaving and cutting the elephantine monster that had been corralled was finally gotten free—at a cost of a thousand dollars in damage to the net.

A Monterey Sicilian whom the writer questioned about the presence of sharks in the bay there declared: "Yeh! We gotta heem allaright—*beeg* one, lika submarine! No fun for fall overboard, I tell you dat!" But this last remark was entirely facetious, for although their enormous proportions make their appearance an awesome sight, no man really fears a Jonah's fate from the torpid beasts.

Noncarnivorous Foragers.

Boatmen have an explanation for every phenomenon of the sea. Coincidences and appearances seem to their lay reasoning as acceptable evidences of fact, thus it is common belief among them that the "whales" (for so they speak of the big baskers) feed on pilchards. This is the outgrowth of the observed fact that these sharks often are encountered in the midst of schooling sardines. It does not occur to the fishermen that perhaps the sharks and pilchards are mutually

agreeable, and that they happen to be found together for the sole but excellent reason that both are feeding on the same masses of plankton and diatom life that swarm in the water there. Baskers that have been taken ashore for examination have been found to contain gallons of fresh plankton in their stomachs without the slightest trace of sardines or other like fish being discovered present. Moreover, the teeth of the species are degenerate and in no way suitable for a predacious, meat-eating creature, and a highly developed system of gill-rakers is found within the basker's mouth, nature having provided a set of strainers there which parallels the baleen of certain whale species. It is because of this whale-bone appearance that the basker is known in some parts of the world as the "bone shark," or improperly, as the "whale shark."

Introducing "Chuck" Gilkey, the Shark Harpooner.

Riding at anchor somewhat seaward from the outer end of the municipal fish wharf of Monterey you can descry a handsome white-painted cabin cruiser of rather unusual proportions. Should the breeze swing her broadside you may make out her name to be the *Two Brothers*, and if your interest carries you farther, you can learn, by applying at the local office of the Division of Fish and Game, at the wharf-head, that the owner is Chester E. Gilkey, radio electrician, sportsman, and skipper of summer outing parties aboard his white cruiser. Gilkey—or "Chuck," as he prefers to be called—has revived the ancient business of heaving lily-irons into the bulky carcasses of sea creatures, having commenced this joyous avocation out of curiosity to see what would happen when a 160-pound man drives five feet of steel into a shark weighing tons. He continued at the precarious sport because it invested him with notoriety and stimulated the popularity of the *Two Brothers* among landsmen voyagers, who paid to go along on cruises that they might witness the feat and derive a vicarious thrill—"get a kick" by proxy, if you please.

Look Out for His Tail!

"How long a plank have you, and what sort of pulpit do you use?" I asked young Gilkey.

"I never have had to use a plank," he answered. "I stand in the bow and strike them from there. It is no trick getting up to them—they are all regular Rip Van Winkles, sound asleep for twenty years!"

He tells of having run against them with his launch, and describes the usual manner of harpooning as that practised by Nantucketers of yore who chanced upon a sleeping whale: To "beach" the boat upon the "fish," the bow-man sinking the iron into the animal at exactly that instant of contact. The whale would awake with a start, aroused both by the jar of the impact and by the sting of the steel, and sound with an elaborate gesticulation of flukes which invariably came down upon the surface of the sea with a resonant and crashing defensive blow at the moment of submerging. It was this terrible wallop of the punitive tail that was so dreaded by the whalers; the moment that a bowman planted his iron, all hands fell frenziedly upon their oars, backing for dear life in an effort to get out of range before the whale should deliver his parting salute. On the occasions when crews were too tardy in this maneuver, and the wounded animal made correct selection of

the place whereon to strike, splintered fragments of boat floated upon the sea, and a few years later, perhaps, monuments were erected in old Nantucket, or tablets set in the gray stone walls of the Seamen's Bethel, New Bedford.

The new story is not very different.

"We have to look out for their tails," said Chuck. "They have such weight that if they ever hit you—well, that's what makes it sport."

Tons of Mushy Meat.

One might think that with the spearing made easy because of the natural slothfulness of these sharks, to finally capture them would be simple, and merely a matter of time. But no, says Gilkey, the real crisis comes after the making fast, "and it isn't a question of the fight that they put up, either. This is how it always happens: Just as soon as you hit a shark, he sounds. He goes straight to the bottom and rolls around there on the mud, trying to work the harpoon out of his body. And the surprising thing is that he succeeds in about half of the instances. Last summer I struck 18 sharks; 9 of them I landed: 9 got

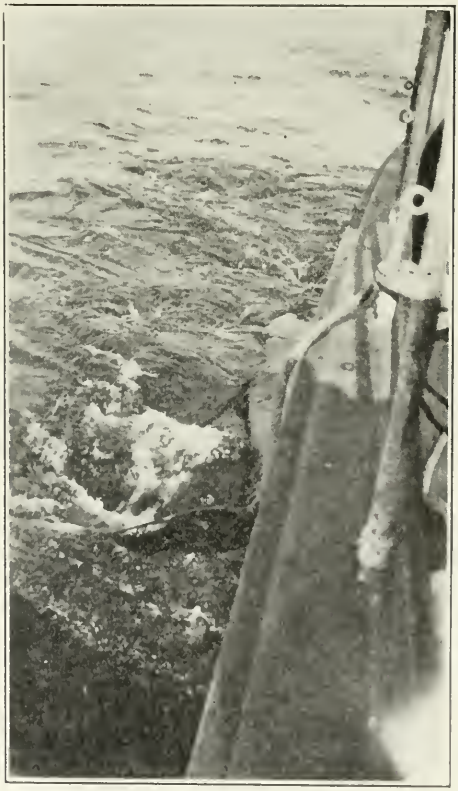


FIG. 54. The *Two Brothers* towing home a 20-foot basker that had required 3 hours of playing to kill. Gilkey states that three is the largest number of sharks he has harpooned and captured in a single day. Photograph by Gilkey, 1929.

away. Two broke the three-quarter-inch manila line and carried off my harpoons, but the other seven pulled out the irons."

The muscular tissues of these animals are described as watery and flabby in the extreme. Unless the harpoon is planted in the boney sections of the head, or is driven through the rubbery skin of the cartilaginous fins, the probability is great that the shark will roll around until finally twisting out the toddle-head on the shaft, *even though the iron has been thrust entirely through the fish.*

Shark Products.

It is this high percentage of loss through escapement that makes the fishery unprofitable from the standpoint of the simon-pure operator, says our authority. Had he not supplemented his gross income by carrying passengers or spectators, the work would have been done at a loss. Usually eight or nine individuals were ready to pay $1.50 for a passage, and in this way the running expenses of the big launch were met. Whatever was derived from the sale of sharks represented profit.

All of the fish taken were disposed of to Max M. Schaefer, whose activities at Monterey and Seaside have centered about the production of commercial products through the utilization of waste materials of a wide variety of sorts. Schaefer paid $7 a ton for the big fish, producing two distinct salable articles from them: liver oil and meat scrap or meal.

The quality of the oil is said to have been excellent—a clear, white fluid, high in viscosity and of good price. It is said to have enjoyed ready request at 60 cents or more per gallon. Petaluma poultrymen, skilled in compounding scientifically balanced egg-producing chicken rations, combine the costly oil with other foods and feed it to their laying flocks for the virtue of vitamins, in which the oil is excessively rich.

It is well known, of course, that certain fishes in the sea store much of their fat in the liver. The cod family is noted in this respect, the cod, haddock, pollock, cusk and hake constituting a vast population, numerically, of this type of bottom-feeder. Sharks of all sorts likewise have the same characteristic, and indeed shark-liver oil is not to be distinguished from liver oils of the cods except by experts equipped with scientific apparatus enabling chemical analysis. It has been claimed that the basking shark—the sort obtaining at Monterey—is the world's record holder for enlarged liver, and that no other fish produces so much oil in proportion to its gross weight.

"The largest shark that we harpooned *and landed* weighed about three and a half tons," states the fisherman. "We took more than 1200 pounds of liver out of that one, and this produced 155 gallons of pure, white oil. But the flesh was so watery that little was realized from it. There seems to be so little substance in it that when processed nothing remains. I would say that the average shark gives only about 150 pounds of meal—and queer-looking stuff it is, too; looks like shredded wheat, or something of that sort.

"The liver oil is the main thing; from the nine sharks something over 950 gallons of oil were produced."

Selecting Small Ones.

Probably Gilkey's estimates and figures should not be taken as exactly representative of what the fishery would do were it developed seriously. This cautioning is based upon his own declarations that the two largest sharks that he struck both came to the surface after an initial dive to the bottom, and by plunging around parted his line. Moreover, he exercised a certain degree of caution in selecting from among the drowsy schools of finning fish some individual of a size suitable for tackling.

"There are sharks out there as big as a small whale," he says. "Why, the largest one that we brought in was more than thirty feet long, and it didn't begin to measure up to some of the others. We saw one out there that certainly was twenty feet longer than the *Two Brothers*, and she is a fifty-footer. Of course, we weren't wanting to tackle anything like that."

Candidate for a Jonah.

But our friend Chuck's great circumspection about making fast to too monstrous a monster is seemingly belied by his apparent abandon and injudiciousness in sallying nonchalantly to sea in a skiff to worry the sleepy old liver-fish. First of all he harpooned two of them from a 22-foot speed boat having an outboard motor—and spent three hours towing one of these a distance of only two miles. Then, on an occasion when one of the creatures was stupidly following Gilkey's skiff, the boatman stood up with the iron and crashed it through the fish's head. When finally it was gotten ashore it was found to be twenty-five feet long.

Tenacious of Life.

Sharks are an undeveloped and exceedingly primitive sort of animal, comparing with the skates and rays and other low forms of fish life in that they have cartilaginous frameworks instead of bony skeletons, and an undeveloped nervous system. This latter renders them hard to kill, for, like many fish and reptilian forms, they will continue to manifest life even after having been horribly injured, or even dismembered.

"When one of them has exhausted himself rolling around on the bottom we pull him up. It may seem strange, but it is a fact that they always come to the top tail first. They are very hard to kill, and you have to shoot them in a certain small spot in the gills or they will go on living for hours."

By-Products Overlooked.

"What did you do with the skins, and to whom did you sell the fins?" I asked the harpooner.

"Funny thing about that," said Chuck. "We never tried to skin them at all—but they certainly have a tough hide. In fact, the hide is about all that holds the harpoon in them at all; it ought to make fine leather.

"And about the fins: well, we didn't know that they were worth anything. We hauled the fish up on the beach and then the Chinamen came along at night and stole all those fins We didn't find out until

later that they were worth about as much as the rest of the fish. About the time that we quit fishing one of the Chinamen came to see me about getting all of the fins—he was a sly old fellow; wanted me to set the price."

So certain canny Orientals have had sundry barrels of sharkfin soup free of cost at this, their New Year's season.

Now a word from Milton Lindner again: "I even tried eating these fellows. In October one was landed that measured twenty-four feet and weighed two and three-quarters tons. Some sardine boat brought it in. They cut it open there on the beach and exposed the long gray liver which was an enormous organ. When it was tried out it produced over 100 gallons of colorless, odorless, tasteless oil—better to every appearance than any cod liver oil I ever saw. It sold to egg-raisers for about 60 cents a gallon.

"Well, the meat of the fish looked so fresh and good that I decided to try eating some of it. I cut out a nice steak and took it home, where I fried it. It turned out to be as tender as the finest of steer beef, but it savored of ammonia somewhat, and was not really suited for frying. If I had parboiled it first it would have been excellent."

Lindner explains that the displeasing taste of fried shark flesh results from the fact that these fish have a slow elimination of uric wastes from their blood. At all times there is present in the tissues a considerable amount of substance that is incompatible with fine flavor unless the food be prepared in a manner which will free it from the accumulation of nitrogenous matter.

Scientific Dope.

Dr. David Starr Jordan, the great ichthylogist of Stanford University, has written briefly on the Monterey "elephant shark" in his volume entitled "Fishes," pages 196–197:

"The largest of all living sharks is the great basking shark (*Cetorhinus maximus*), constituting the family of *Cetorhinidae*. This is the largest of all fishes, reaching a length of 36 feet, and an enormous weight. It is a dull and sluggish animal of the northern seas, almost as inert as a sawlog, often floating slowly southward in pairs in the spring and caught occasionally by whalers for its liver. When caught its huge flabby head spreads out flat on the ground, its weight in connection with the great size of the mouth-cavity rendering it shapeless. Although so clumsy and without spirit, it is said that a blow of its tail will crush an ordinary whaleboat. The basking shark is known on all northern coasts, but has most frequently been taken in the North Sea, and about Monterey Bay in California. From this locality specimens have been sent to the chief museums of Europe. In its external characters the basking shark has much in common with the man-eater. Its body is, however, relatively clumsy forward; its fins are lower, and its gill-openings are much broader, almost meeting under the throat. The great difference lies in the teeth, which in *Cetorhinus* are very small and weak, about 200 in each row. The basking shark, also called elephant shark and bone-shark, does not pursue its prey, but feeds on small creatures to be taken without effort. Fossil teeth of *Cetorhinus* have been found from the Cretaceous, as also fossil gill-rakers, structures which in this shark are so long as to suggest whalebone."

Big Shark Schools.

During many years past Icelandic fishermen have prosecuted an annual summer fishery for the basking shark. In that country many people depend for their livelihood upon the products of this enterprise. Liver oil is naturally the primary interest, but the entire fish is utilized. Chroniclers who assert that they have witnessed the Icelandic operations tell that the boatmen go to sea armed with harpoons and lances as secondary apparatus to accordions or other musical instruments with which to lure the fish within reach. It seems that the basker is mildly curious; it is characteristic of him to follow boats. The Icelanders believe that he will follow more closely in order to hear their music, and so set up a high-seas concert until such time as a shark comes up close enough to stick an iron into him. These six-foot island Nordics credit the fish with artistic discernment, so play at being male Lorelei by singing and wielding a concertina, using music and art as the seductive bait—as many another astute fisher has done!

But whereas off Iceland, and elsewhere generally, these animals show themselves only in pairs or as lone individuals, Gilkey declares that in Monterey Bay they often are seen lying together in whole rafts.

"They are here all the year round, I am sure of that," he says. "The reason that they are not seen more often is that they lie close to shore, in waters where fishermen seldom go. Almost always we can find them close along the beach, rarely more than half a mile from the land. It may be that they collect there because the shoal water is warmer than farther out—anyway, that's where they fin. I have seen as many as 500 of them schooling together at one time, and to spot fifteen or twenty together is the regular thing."

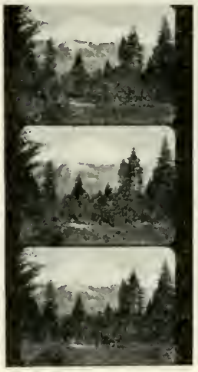
If the resource really is abundant, and if through annual migrations the local supply is replenished, there seems a possibility of fine profits for someone who will undertake its exploitation, properly equipped and in serious fashion. Were the skins utilized, and the fins prepared for the Oriental market, no doubt the individual sharks would contribute twice the return that has been derived thus far. The Schaefer reduction company is said to have accepted willingly all of the fish that have been brought to it in times past, be it market trimmings, Vito Bruno's trawl-caught dogfish, or Gilkey's basking sharks. As soon as it opens its new establishment it will no doubt be in position to receive industrial fish again.

Should the utilization of sharks attain considerable proportions in Monterey Bay, old residents may have recollection quickened by a return of the days of the ocean chase, and the subtropic "Nantucket sleigh-ride." The "pueblo's" veteran citizens remember when boat crews put out from shore-stations on the beach to pursue plume-like spouts espied by watchers stationed on Presidio Hill. In those times the intoned hail of the lookout man terminated the noon siesta with an abruptness and finality that was entirely unnative: "Tha-a-ar she blo-o-o-ows! One p'int off the rocks, thar." But in future there will be no tar barrel made fast in some tall tree's top. Instead, the harpoon-boat will sally to sea on a sunny morning, following the strip of white sand beach around the wide arc of the bight until the lookout in the crow's nest, or perhaps the gunner on the forecastle head, will sing out the tidings of profit: "Fins—Oh! Give 'er a spoke to starb'rd, Sam.

There! Steady as she goes—port a little, port, port, *PORT!* Stea-a-a-ady! Slow bell! Let 'im have it!" And as the crash of the Sven Foyn jerks up the bow of the little tug, an echoing thud sounds from beneath the sea where the detonating bomb exploding at the harpoon's point makes a short end of the shark—and a sure prize of the rich liver—before the stupid fish has time to take fright, and sound.

CONSERVATION THROUGH VISUAL EDUCATION

A List of Educational Films for Loan by the Division of Fish and Game, California Department of Natural Resources



Ever since motion pictures came into wide use for entertainment and instruction, the Division of Fish and Game, Department of Natural Resources, has been acquiring educational films depicting the fish and game resources of California. Educators complain that too much prominence is given to knowledge gained from books and point to the need for closer contacts with the living object in its natural environment. Hence, the Division has made a consistent effort to acquire natural history films which show the life history and characteristics of important species in their natural setting.

The game animals of the state that are noted for their abundance and wide distribution have been made the objects of an accurate visual record, and those that are known for their scarcity and isolation are shown in their native habitat. Special apparatus and telephoto lenses were used in taking pictures of mountain sheep, antelope and little brown crane. Practice, patience and perseverance were necessary to make the first photographic record of the nesting and home life of the long-billed curlew and pinyon jay.

Throughout each series, emphasis is placed on the need and value of California's fish and game resources. The pictures also serve as visual aids to an understanding of the methods and means being employed by the Division to protect and produce game. Many of them are designed for school use and are suitable as visual aids in courses on the conservation of natural resources. Others emphasize features of interest to sportsmen and fish and game organizations.

These wild life films are available for loan to responsible organizations throughout the state. Since no charge is made for their use, it is expected that the borrower will pay carrying charges and will be responsible for any serious damage.

These films are utilized also to illustrate lectures on the conservation of fish and game given by the staff of the Bureau of Education and Research. A serious effort is made to make this lecture service statewide, rather than confining it to the more densely populated areas of

California. No charge is made for these programs, but sponsors are expected to furnish a standard film projector and competent operator.

Requests for motion pictures or lecturers should be addressed to the Bureau of Education and Research, Division of Fish and Game, 510 Russ Building, San Francisco, California.

LIST OF MOTION PICTURE FILMS

January, 1930

Standard 35 mm., 1000-foot reels.

FISH

Game Fishes

Trout

*1A **Trout Culture and Angling.** By E. A. Salisbury.
Close up view of trout. Operations Mt. Shasta Hatchery—artificial spawning, culture of trout eggs and hatchery operations. Planting. Angling for steelhead on Klamath River.

1B Same as above.

*2A **Life History of Steelhead Trout.** By George Stone.
Prizma color. Dams, impediments to natural migrations; fish ladder and screen. Egg-collecting station on Klamath River—trapping steelhead, artificial spawning. Operations at Mt. Shasta Hatchery—culture of eggs. Planting. Catching large steelhead on the Eel River.

2B Same as above—also shows microscopic food of trout.

2C Same as above.

3A **Trout Cultural Operations at Mt. Shasta Hatchery.** Photography by Sidney Snow and others. Edited by Rodney S. Ellsworth.
Panorama Mt. Shasta Hatchery. Close up views of trout. Artificial spawning and hatching operations.

†4A **Trout Transportation and Planting.**
Transportation by rail to Yosemite National Park. Planting in High Sierra lakes and streams.

20A **From Hatchery to Creel.** (Trout cultural operations in California.) (Three reels.) Photography by Sidney Snow. Edited by Rodney S. Ellsworth.
Part 1. Mt. Shasta Hatchery—brood stock and ponds. Trout cultural operations—artificial spawning, care and culture of eggs.
Part 2. Mt. Shasta Hatchery (continued). Hatchery operations—feeding trout fry and fingerlings. Transportation of fingerlings by rail to Yosemite National Park.
Part 3. Transportation of fingerlings by truck and pack animals to High Sierra. Planting from truck in Tenaya Lake and Tuolumne Meadows. Fishing scenes—Lake Almanor. Catching large steelhead, Klamath River.

Salmon

25A **Salmon, King of Fishes.** By H. C. Bryant.
Salmon culture operations—trapping salmon at Klamathon, artificial spawning. Hatching eggs at Mt. Shasta Hatchery, scientific investigations—age studies and migrations. Klamath Indian ceremonies.

26A **Salmon Egg-taking at Klamathon.** Photography by Sidney Snow. Edited by Rodney S. Ellsworth.
Trapping and spawning salmon.

27A **Salmon Culture, Salmon Hatching at Mt. Shasta.** Photography by Sidney Snow. Edited by Rodney S. Ellsworth.
Biological development of salmon eggs. Care of fry.

Angling

35A **Trout Angling.** (Lessons in fly casting.) By H. C. Bryant and E. S. Cheney.
Close up of trout fishing scenes. Fly and plug casting.

†40A **Steelhead Angling.** By E. S. Cheney and others.
Close up steelhead. Fishing scenes, tidewater and stream.

45A **Out for Stripers.** By E. S. Cheney.
Striking evidence of the sport furnished by the successful introduction of the striped bass in California. Fishing scenes San Francisco Bay and sloughs.

†46A **Introduced River Fishes.** (Spiny-rayed fishes.) By E. S. Cheney and others.
Close up views of black bass, blue-gill sunfish and others. Angling for black bass. Rescuing stranded fish and planting in live waters.

COMMERCIAL FISHERIES

Marine Fishes

50A **Sardine Fishery.**
Sardine boats and gear. Fishing for sardines, Monterey Bay. Canning operations.

*55A **Tuna Fishery.**
The tuna industry from the capture of the fish to the finished canned product.

55B Same as above.

60A **Shad of California.** By E. S. Cheney.
Shad boats and gear. Fishing for shad, San Joaquin River. Shad roe. Canning operations at Pittsburg.

†75A **Fresh Fish Market Supply.** By E. S. Cheney.
Salmon, halibut, barracuda, sole, sandabs, rock fish, yellow tail, herring, sea bass, bonito. Fishing scenes. Methods of fishing—boats and gear. Fresh fish markets.

†78A **Fish Canning Industry of California.** By E. S. Cheney.
Scenes at canning centers. Methods of canning sardines, mackerel, tuna, skipjack, albacore, anchovies By-products—fertilizer, oil, etc.

Mollusks

80A **Pismo Clam.** By E. S. Cheney.
Life history. Scientific research—yearly census. Methods of digging for clams. Apprehending violators.

Crustaceans

90A **Spiny Lobster.** By E. S. Cheney.
Life history. Fishing boats and traps. Methods of preparing lobsters for market. Law enforcement and inspection.

BIRDS

Game Birds

*100A **California's Waterfowl.** By H. C. Bryant and E. S. Cheney and others.
Ducks and geese.

100B **California's Waterfowl.** By H. C. Bryant and E. S. Cheney and others.
Hunting scenes. Mallards, pintails, canvasbacks. Ducks and geese in flight, Sacramento Valley. Ducks on California's oldest game refuge. Whistling swans.

105A **Ducks of California.** By H. C. Bryant and E. S. Cheney.
Hunting scenes. Mallards, pintail, teal, widgeon, ruddy duck, canvasback. Lake Merritt Refuge. Life history—nesting waterfowl.

115A **Geese of California.** By H. C. Bryant and E. S. Cheney.
Canada goose, speckled-belly, Hutchin's goose, snow and Ross geese. Life history of Canada goose—nesting, goslings, and home life. Hunting geese.

119A **Goose Hunting in California.** By E. A. Salisbury.
Historical. Bag of over 100 geese at Mallard, Solano County, 1913. Shooting from pits, live decoys, professional goose callers.

120A **Duck Disease.** Photography by E. S. Cheney. Edited by H. Van Roekel.
Loss through disease. Scientific investigation—attempts to discover causes. Methods of prevention and treatment.

122A **Waterfowl Refuges in California.** Photography by E. S. Cheney. (Two reels.)
Part 1. Ducks on Lake Merritt, California's oldest game refuge. Scenes on Richardson's Bay and bird life. Development of Los Banos Refuge (purchased by state, winter of 1929.) Closeups of ducks, geese and swans attracted to refuge.
Part 2. Home Life of Birds in Los Banos Refuge. Life histories and habits of some ducks, shorebirds and marsh birds.

*125A **Shorebirds.** Photography by E. S. Cheney. Edited by H. C. Bryant.
Nesting and young of long-billed curlew (first photographic evidence.) Young black-necked stilts and American avocets. Nest and eggs of western willet. Killdeer, mountain plover, dowitcher, jacksnipe, sanderlings and sandpipers.

*130A **Little Brown Cranes.** By E. S. Cheney.
Life history. Wintering brown and sandhill cranes in California.

131A **Marsh Birds.** Photography by Donald Dickey, E. S. Cheney and others. Edited by H. C. Bryant.
Mud hens, grebes, rails, herons, American bittern, egret and glossy ibis.

135A **Upland Game Birds.** By H. C. Bryant and E. S. Cheney.
Band-tailed pigeon, Sierra grouse, sage hen, valley quail. Quail hunt with dogs.

†136A **Quail.** Photography by E. S. Cheney. Edited by E. S. Cheney and D. D. McLean. Life history and home life. Valley quail, mountain quail, desert quail.

†137A **Sage Hens and Grouse.** By H. C. Bryant and E. S. Cheney.
Life history and home life.

†138A **Band-tailed Pigeons and Doves of California.** By H. C. Bryant and E. S. Cheney.

145A **California's Game Farm.** By H. C. Bryant.
Propagation of Chinese ring-necked pheasant, Yountville Game Farm. Display pheasants, peacocks.

146A **Propagation of Quail and Other Game Birds, Yountville Game Farm.** Photography by Sidney Snow and others. Edited by Rodney S. Ellsworth.

*147A **Game Bird Propagation.** By Sidney Snow. (Two reels.)
Part 1. Propagation of Chinese ring-necked pheasants, state game farm, Yountville. Birdseye view of game farm. Preparation of food. Breeding stock. Incubating eggs—use of domestic mothers.
Part 2. Propagation and liberation of Chinese pheasants. Care of young pheasants under artificial conditions. Methods of liberation of immature and mature birds.

†170A **Bird Migration.** Photography by E. S. Cheney. Edited by E. S. Cheney and D. D. McLean.
Congregating before migration. Routes of migration—flocks and individuals on the way—arrivals and departures.

Non-Game Birds

*175A **Bird Life on Clear Lake.** By E. A. Salisbury.
Cormorant, white pelican and heron rookeries. Home life, showing nests, eggs, young and adults.

*176A **Bird Life on the Farallon Islands.** By E. S. Cheney.
Nesting birds—murres and puffins. Sea lion and seal rookeries. A whaling vessel in action.

176B **Bird Life on the Farallon Islands.** By E. S. Cheney.
Nesting birds—cormorants and western gulls.

*177A **Feathered Fighters of the Farallon Islands.** By E. S. Cheney.
The story of the struggle for existence by sea birds. Life histories and interrelations.

178A **Birds of California Coast Islands.** Photography by Donald Dickey and E. S. Cheney. Edited by H. C. Bryant.
Brown pelicans, murres and other seabirds.

180A **Predatory Birds.** Photography by H. C. Bryant and E. S. Cheney. Edited by H. C. Bryant.
Home life of osprey. Young of golden eagle and turkey buzzard. Great horned owl and burrowing owl. Nesting habits of prairie falcon, red-tailed hawk, marsh hawk and Swainson's hawk.

185A **Song Birds.** Photography by H. C. Bryant, E. S. Cheney and Donald Dickey. Edited by H. C. Bryant.
Mockingbird, least vireo, bush tit, house wren.

186A **Song Birds.** Photography by E. S. Cheney and Donald Dickey. Edited by H. C. Bryant.
Chickadee, Sierra creeper, russet-backed thrush, wren tit. Nests of sage sparrow, horned lark, California song sparrow. Birds at feeding table.

190A **Non-Game Birds.** By E. S. Cheney and Donald Dickey. Edited by H. C. Bryant.
Gulls and terns.

191A **Non-Game Birds.** Photography by E. S. Cheney and H. C. Bryant. Edited by H. C. Bryant.
Blue jays, pinyon jays (first photographic evidence), black-billed magpies, hummingbirds, swallows and black-crowned night heron.

192A **Non-Game Birds.** Photography by E. S. Cheney and H. C. Bryant. Edited by H. C. Bryant.
Hairy and white-headed woodpeckers, swifts, roadrunner, blackbirds. Pigmy and red-breasted nuthatches, western kingbird and black phoebe.

†198A **Bird Architecture.** Photography by E. S. Cheney. Edited by E. S. Cheney and D. D. McLean.
Nests—their character, shape and construction.

MAMMALS

Game Mammals

200A **California Valley Elk.** Photography by H. C. Bryant and E. S. Cheney. Edited by Rodney S. Ellsworth.
Survivors of countless thousands in their native haunts. Preservation of vanishing big game in Yosemite and other refuges.

210A **Deer of California.** Photography by H. C. Bryant and E. S. Cheney. Edited by Rodney S. Ellsworth.
Methods of conserving big game species. History of deer conservation in California. Black-tailed and mule deer.

*220A **Prong-Horned Antelope.** Photography by E. S. Cheney. Edited by E. S. Cheney and Rodney S. Ellsworth.
History of antelope conservation in California. Survivors in their native haunts.

230A **Big Horn, Mountain Dweller.** By E. S. Cheney.
Life history and habits of desert mountain sheep.

230B Same as above.

Non-Game Mammals

250A **Stealthy Stalkers.** Photography by E. S. Cheney, H. C. Bryant and E. A. Salisbury. Edited by H. C. Bryant and Rodney S. Ellsworth.
Skunks, ring-tailed cat, badger, black bear and cubs, baby bobcats and young mountain lions, wild cats and mountain lion treeing and roping.

†260A **Fur Bearers.**

†270A **Non-Game Mammals.**
Flying squirrels, marmot, porcupine.

DIVISION ACTIVITIES

300A **Conservation Accomplishments in California.** By E. S. Cheney. (Three reels.)
Pictorial record of the program to protect and restore fish and game. Departmental activities related by a deputy in a camp in the woods to hunters.

NATURELOGUE NEWS REELS

370A **Duck Hunting.** By E. S. Cheney.
Just before opening of 1929 season. Duck marshes and ponds. Opening day—some good bags.

MISCELLANEOUS

400A **Friends of the Summer Vacationist.** Photography by H. C. Bryant, E. S. Cheney and E. A. Salisbury.
Yosemite Falls, chipmunk, jays, fawn, bear, porcupine. Trinity Game Refuge.

450A **California's Fish and Game.** Photography by H. C. Bryant and others. Edited by H. C. Bryant.
Glimpses of operations Mt. Shasta Hatchery—salmon culture. Close up views of river fishes. Important game species—deer, elk, bear, ducks, geese and grouse.

‡1000 **From Hatchery to Creek.** (Three reels, narrow 16 mm.)
A portrayal of trout cultural operations in California. Same as 20A.

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* Available only with lecturer.
† In course of preparation.
‡Series 1000, narrow width 16 mm. film only.

CALIFORNIA FISH AND GAME

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All material for publication should be sent to H. C. Bryant, 510 Russ Building, San Francisco, California.

MAY 15, 1930

"The man who illegally takes game and fish cheats his fellow man and defrauds his state."

EMPLOYEES' CONVENTION

The Fifth Annual Convention of Employees of the Division of Fish and Game met at the William Taylor Hotel, San Francisco, on March 11, 12, 13, 1930. Some one hundred and fifty employees were present. It was not possible for hatchery superintendents or their men to attend the meeting because of the rush time of year.

There was a distinct change in the plan of the meeting this year. Practically no outside speakers appeared on the platform and instead the time was devoted to discussion of various subjects by the men themselves. The lack of formality proved helpful and the response was pleasing. There was much wholesome discussion, each man contributing valuable ideas useful in reaching a reasonable solution of the problem in hand. The morning of March 12 was devoted to various subjects concerned with law enforcement and the afternoon to various topics related to game management. On the first afternoon, the men were given addresses of welcome by Director F. G. Stevenot, President I Zellerbach, Commissioner R. G. Fernald and Executive Officer J. L. Farley. Interesting responses were made by the two men oldest in time of service, H. I. Pritchard and J. E. Newsome. Charles A Vogelsang, chief deputy 1901–1910 and executive officer 1920–1922, gave an interesting address on "The Old Days," dwelling principally upon the securing of the hunting license act in 1907.

The evening of March 11 was devoted to a showing of new films: a three reel feature devoted to Division activities, a reel depicting the new waterfowl refuge at Los Banos and a reel of the best scenes taken by official photographer E. S. Cheney during the past year. The program ended with a splendid film depicting fishing on the Klamath which was loaned by the U. S. Forest Service.

The last day was given over to a pistol shoot and barbecue at the Yountville Game Farm. The silver cup which has been in the hands of Deputy Taylor London for two years passed into the hands of Deputy Cliff S. Donham, of Escondido. Deputy London was only two points behind. A special competition passed between teams from the field and a team made up from the office force resulted in a team of three from northern California taking the prize money. A splendid picnic dinner was served under the direction of Walter Welch. The barbecued beef was tasty and bountiful.

In the afternoon a baseball team made up of men from the northern part of the state won the contest from the team from the south.

In many respects this convention was the best held. The men themselves felt that they had a real opportunity to contribute to the success of the meeting. In attendance, it also held a record.

IS FREE HUNTING DOOMED IN AMERICA?

All thinking sportsmen are beginning to wonder whether the American system of hunting can continue in view of the rights of the landowner and the obvious decrease of game. A symposium at the American Game Conference in December participated in by two well known conservationists was devoted to this subject. Both were agreed that changed conditions must bring about a modified system. Increased license fees and perhaps a daily fee for hunting to encourage the landowner were included in suggested modifications in the present system.

The present system will be justly criticized until game is restored and a better feeling maintained between those who raise game and those who hunt it. A thoughtful presentation of this important subject will be found on a preceding page under the title: "The Rights of the Amateur Sportsman." On this page we expressed the thoughts of a field deputy on the subject. The oncoming generation is going to find open hunting difficult if the present one does not respect the rights of those who furnish the hunting grounds.

AREAS CLOSED TO HUNTING

As time goes by more and more each year the rancher and property owner is tightening down on allowing hunters to enter and hunt upon his property. Twice as much acreage is now closed to hunters, in and adjacent to Ventura County, as there was five years ago.

This condition to me looks like one of the largest and most important problems now before the California Fish and Game Commission and the sportsman as well. If the problem exists generally over the state as it exists in this vicinity in a few years the sportsman will have no place to hunt except on land owned by the federal government within the national forests, or by paying landowners a fee to hunt upon their property or will, for the most part, not be allowed to hunt under any circumstances. Most all owners who have posted their property against hunting will, and do, give permits to a selected few to hunt thereon. The average hunter, however, can not get this privilege, but they are at the same time the ones who contribute the most of the license fees to the state.

We are protecting the game on areas that are closed to hunting the same as on areas which are open to public hunting. It is true that these private properties, for the most part, which are closed to hunting do act in some degree as refuges and places where game can breed and increase, but why protect and raise a lot of game if the general public derives no benefit from it.

I have heard many sportsmen the past two years make this remark: "Well, I am going to sell my shot gun and quit hunting because everybody has their property posted and there is no place to hunt. There is no use in buying a hunting license."

This state of affairs, it seems to me, will materially reduce the sale of hunting licenses, and this is a matter that vitally affects the Fish and Game Commission in its operations. I feel there is only one solution of the problem. The sportsmen must get together with the ranchers and property owners, and agree on some action which will allow the sportsmen to hunt and yet will give sufficient protection to the property owner.

I believe it is the duty of all employees of the Fish and Game Commission to assist all they can in getting the sportsmen and property owners together on this matter. These circumstances and conditions in relation to deer hunting are not so provoked, of course, as with small game or bird hunting, because we have vast areas of government lands to hunt this species of game on, but the same lands in many localities do not afford much small game shooting. — Walter Emerick, Ventura, California.

ARE THE DAYS OF FREE SPORT GONE?

It is pointed out very clearly by William C. Adams, director of the division of fisheries and game of Massachusetts, in his annual report, that fishing and hunting can no longer be regarded as cheap sport, according to a bulletin of the American Game Protective Association. Free hunting and fishing can no longer be enjoyed in America in the sense that it can be had for nothing. It is only within recent years that the gunner and angler have paid anything for their sport in the way of license fees, which are as yet ridiculously small when it is considered what is expected by way of return for the expenditure. It is unreasonable to expect the investment of a dollar or two to yield the maximum of game and fish which the gunner and angler is allowed by law to take within each open season. It is time that sportsmen realized that the fish and game they bring to bag can only be in proportion to the investment they make in it. Elaborate and expensive equipment is necessary to maintain the propagation plants which must be supported to produce the large numbers required for planting and there must be greatly increased facilities for management and protection.

Mr. Adams says: "A large percentage of us still persist in nursing the hope that some miracle will occur to restore the abundance of the past. Too many of us insist on harboring the fallacy of the God-given right of free hunting and fishing. Some still nurse the chimera of a so-called American system of free fishing and hunting. These ideas must be thrown into the discard once and for all if we are to deal with this problem on its merits."

Mr. Adams would undoubtedly insist upon maintaining the maximum of opportunity for all citizens on an equal basis and to that end he strongly advocates increased hunting and license fees which would enable the state to increase its facilities for supplying the streams, lakes and fields with fish and game. "The protection and propagation of those forms of wild life which are used for sporting purposes," he says, "is today recognized as a business. In the densely settled sections of the country it is useless to hope for the return of certain species of large mammals classed as game. Likewise it is nursing a dream to expect, in the future, to fish in crystal streams flowing through

primeval forests. In many of our streams and other waters, natural reproduction of the fish life can not be counted on for any appreciable additions to the wild life stock. In many sections only the artificially propagated species of game can be relied on for sport."

WATERFOWL BAG LIMIT REDUCED

Following recommendation by the Advisory Board Migratory Bird Treaty Act, Secretary Hyde of the United States Department of Agriculture announced on December 31, 1929, that he will issue a regulation subject to the approval of the president cutting the federal bag limit on wild ducks from 25 to 15 per day; on geese from 8 to 4 per day; and providing for a possession limit of 30 ducks and 8 geese for the 1930–31 season.

For several years there has been a trend of sentiment toward a reduced bag limit. A year ago when the Advisory Committee met it looked as if a favorable recommendation would be forthcoming, but decision was made to await further data as to decrease which was being secured by the United States Biological Survey. This year the chief of the Biological Survey reported that the investigation indicated that waterfowl have not been returning in usual numbers. As indicative of a changing sentiment, it should be noted that some 29 different states have reduced the bag limit below that set by the federal government.

Though a strong sentiment favoring reduction has developed in most other states, opinion is still markedly divided in the states of Louisiana and California. In our own state, members of a duck club organization have fought the reduction of the limit, maintaining that increased feeding grounds were far more important than the bag limit reduction. On the other hand, a majority of unattached sportsmen appear to have favored a lower bag limit. The reduction has been vigorously insisted upon by the principal game associations, the Izaak Walton League of America, the Western Association of Game Commissioners and the Association of North Central States Game Commissioners. At its annual meeting in December, 1929, the American Game Conference adopted resolutions to this end.

The new regulations will go in force before the opening of the next waterfowl season. It is expected that there will be little trouble relative to violations in that most sportsmen will wish to take any step which may improve the status of wild fowl.

WHO IS GOING TO ENFORCE THE 15 BAG LIMIT ON DUCKS?

Ever since the Secretary of Agriculture issued a statement indicating that federal regulations now provided for a fifteen bag limit on ducks, there has been much discussion as to how the regulation could be enforced in California where a twenty-five bag limit was recently ok'd by a session of the legislature. It is evident that state officials can not take an active hand in enforcing the new bag limit. Many are, therefore, predicting conflict of authority and numerous violations when the duck season opens next December. The situation, however, is not serious, for there is a federal game warden in California and he has authority to appoint numerous deputies. Furthermore, federal game wardens could easily be concentrated in those states where difficulties were expected. The danger of being hailed into a federal court will be a deterrent to all except those who are willing to take a chance.

But why this discussion? Who is going to violate the law? Will a true sportsman, even if he believes in states' rights, purposely violate a law designed to help his sport? Will those who have talked most about their altruistic interest in conservation attempt to upset a plan backed by the organized group of fish and game commissioners of western states? Will the minority systematically violate a regulation because they do not approve of it? We think not.

MORE ATLANTIC SALMON FOR CALIFORNIA

Assurance that the experimental introduction of the Atlantic salmon into suitable waters in California, is to be continued is to be found in the announcement that 20,000 eggs of this fish have been allotted to California by the United States Bureau of Fisheries. In addition an exchange agreement has been entered into between the Bureau of Fish Culture and the Department of Marine Fisheries of the Dominion of Canada for an additional 25,000 Atlantic salmon eggs.

These eggs will be delivered in the spring and will be hatched and reared at the Cold Creek Hatchery in Mendocino County. The water supply of this hatchery has been found to be particularly adapted to the rearing of this fish. During the season of 1929, 25,000 Atlantic salmon were reared in this hatchery.

The propagation of Atlantic salmon by the Bureau of Fish Culture is being carried on in an effort to establish this species in the streams of the northwestern portion of the state where it is expected to greatly improve sport.

IN MEMORIAM

EDWARD D. RICKETTS

Deputy Edward D. Ricketts, one of the veteran deputies in the Patrol Department, was stricken by the hand of death January 4, 1930, at Coachella, California. Mr. Ricketts was appointed as a deputy on October 1, 1910, and served for many years at Live Oak in the Sacramento Valley. On account of his varied experience, Mr. Ricketts was particularly valuable in the duck country. He knew ducks and their habits as few men do. In more recent years he was stationed in southern California, more recently in the Imperial Valley.

He was born at Live Oak, California, in November, 1881. The remains were shipped to Live Oak for interment. A son, Edward D. Ricketts, Jr., 12 years old, lives at Daly City, California. In addition to his son, a sister and two brothers, he leaves a host of friends to mourn his sudden passing. As he was a member of the Benevolent Protective Order of Elks, it is fitting to quote:

"The faults of our brothers we write upon the sands,
Their virtues upon tablets of love and memory."

STREAMS CLOSED TO FISHING, 1930

In keeping with the plan to work with the sportsmen of the state in conservation matters, the Division of Fish and Game of the Department of Natural Resources has announced a program of stream closing to be effective when the trout season opens in California on the first of May.

In order that sportsmen, vacationists and resort owners may be forewarned of the proposed closing of certain streams to angling, a list of the streams where fishing will be prohibited has been prepared. In all cases these streams have been set aside only upon a showing that the proposed steps are essential to the conservation of trout.

The purpose of this closing order is to further protect the trout with which the various waters of the state have been stocked, of insuring their growth and better means of propagation as well as providing an adequate supply of trout eggs for the various trout hatcheries, to the end of improving fishing conditions generally throughout the state. The streams closed represent only a very small proportion of the fishing waters of the state.

The following areas are affected by the closing order:

Sacramento River Water Shed

Modoc County—Mill Creek and tributaries above Clear Lake in the South Warner district.

Shasta County—All of Hazel and Shotgun creeks and tributaries; Old Cow Creek from the P. G. & E. Co's. hydro-electric plant to its source.

Siskiyou County—All of Soda Creek and tributaries.

Tuolumne County—Phoenix Lake and tributaries closed during 1930 (does not include Sullivan Creek). Emigrant, Buck, Deer and Huckleberry lakes and all tributaries closed until July 1, 1930.

Plumas County—Clear Creek and tributaries, Thompson Creek and tributaries, Tollgate Creek and tributaries, Black Hawk Creek and tributaries, Rock Creek and tributaries, all in the vicinity of Quincy; Red Clover Creek and tributaries (a tributary of Indian Creek); Butt Creek from Almanor Tunnel to

Butt Lake (Butt Creek closed only from November 1 to May 29); Mosquito Creek, tributary to the Feather River near Belden; Hamilton Branch of the Feather River from the Iron Bridge located three-fourths mile above the Red River hydro-electric plant to the mouth of said branch, and thence all of that portion of Lake Almanor within a radius of 300 feet of said mouth.

Sierra and Plumas counties—All streams flowing into Gold, Grass, Jamison, Smith, Long, Round and Rock lakes for a distance of 2000 feet upstream from their mouths and all outlets for a distance of 2000 feet from the lakes and all that portion of the lakes within a radius of 300 feet of their inlets and outlets will be closed until July 1, 1930, and will close after September 30, 1930. All of these lakes are located in the Mt. Elwell section near Blairsden.

Nevada County—Culverson Lake and tributaries, Upper and Lower Lindsey lakes and tributaries.

Tahoe and Truckee River Water Shed

Martis (a tributary of Truckee River), Alder (a tributary of Prosser Creek), Sage Hen (a tributary of Little Truckee) and all their tributaries; Griffs, Slim Jim, Burton, Ward, Blackwood, Madden, McKinney, General, Meeks, Lonely Gulch, Rubicon, Eagle, Cascade, Taylor, Upper Truckee, Trout and Cold creeks and all their tributaries. All of these streams with the above exceptions are tributaries of Lake Tahoe.

El Dorado County—Waco or Crystal, Pyramid, Gefo, Jabu or Summit, Cup, Clyde or Emerald, Round, Elbert and Dardanelle lakes.

Alpine County—East and West Carson rivers from the California-Nevada boundary line to their sources, closed to May 30, 1930. Winnemuca, Scotts and Burnside lakes and tributaries closed to May 30, 1930.

San Joaquin Water Shed

Tulare County—Brush Creek and tributaries and Tobias Creek and tributaries. Kern River and Big Kern Lake between Horse Trail Bridge and the outlet of Big Kern Lake.

Fresno County—All streams and their tributaries flowing into Huntington Lake except Big Creek.

Coast Counties

Humboldt County—Prairie Creek and tributaries to its junction with Redwood Creek. All that portion of Dobbyn Creek and tributaries lying in Humboldt County.

Mendocino County—All that portion of the North Fork of the Noyo River and tributaries above its junction with the Noyo River at North Spur.

Lake County—Willow, Rice, Deer, Trout, Soda and Salmon creeks and tributaries.

San Mateo and Santa Cruz counties—Pescadero and Butano creeks and all tributaries above tidewater.

Santa Cruz County—All waters after August 1, 1930, except tidewater.

Southern California

Mono and Inyo counties—Middle Cottonwood Lake and streams connecting with lakes above and below. Reverse Creek and tributaries between June Lake and Rush Creek. That portion of June Lake lying north of an east and west line drawn to close the north one-third area of said lake.

Many streams that were closed during the 1929 season will be open to fishing this year. In Humboldt County, Yager and Anderson creeks will be open. In El Dorado County, Rainbow, Grouse, Toem and LeConte lakes will again be open. Bunker Lake in Placer County is again open to fishing. All streams flowing into Shaver Lake and all streams tributary to Dinkey Creek in Fresno County are open. In Tulare County, McIntire, Boulder, Bear, Coy and Alder creeks and tributaries are open. In southern California, Devil's Canyon Creek and tributaries in Los Angeles County and Holy Jim Creek and tributaries in Orange County will be open.

CLUB PLANTS MORE THAN A MILLION TROUT

The Mt. Ralston Fish Planting Club of Sacramento has put energy into a single project, that of systematically and wisely stocking the lakes and streams of the Echo Lake region. Last year the club planted 1,058,032 trout. Many of the lakes planted by the club during 1925, 1926, 1927 and 1928, were restocked.

The club has now planted ten lakes which never before had trout in them, and five other lakes in which little or no evidence of fish life could be found. Such of these lakes as were planted in 1925, 1926 and 1927, were carefully inspected during the past season and the trout showed wonderful growth, giving promise of rare sport in the years to come.

With the heavy stocking of these waters the members have turned their attention to the planting of trout foods, and this matter will receive most careful consideration during the coming season. Four years ago *gammarus* (fresh water

shrimp) were introduced into several of the lakes. These *gammarus* are taking hold in several areas where they were introduced, but enough time has not yet elapsed to forecast from observation the possible value of *gammarus* in these lakes. *Gammarus* were again planted in 1928 and 1929. In a number of lakes containing mud bottom areas, wild Sierra water lilies and various other water plants and water grasses have been planted.

Such activities are most helpful to the conservation cause.

CALIFORNIA'S DEER

A recent summary of big game animals sent out by the United States Forest Service gives a total of 748,003 deer in all of the national forests of the United States and Alaska. Of that number, 245,000 are credited to the national forests of California. That means that a third of all the deer in the national forests of the country are in California.

The same summary shows that there are in the same national forests 52,231 black and brown bear, of which number 11,200 are to be found in California, almost 22 per cent of the bear population of the forests of the entire country.

PHEASANTS PLANTED IN MONO COUNTY

On December 18, 1929, forty pair of ring-necked pheasants were planted in northern Mono County in Antelope Valley. Though the birds were delivered on the evening of December 16, due to stormy and unsettled weather conditions, they could not be released until December 21. However, they were kept in a very large and clean enclosure until the day of their release.

On December 21, 1929, the pheasants were liberated on the properties of Sampe, Chichester, Pitts and Soomeepon. When out of their cages, some of them flew a quarter of a mile while others flew but a few feet and ran to hide in some sheltering underbrush or willow patch. Most of them when coming out of their cages, would fly straight up for about ten to twenty feet and then straighten out. After settling they would hide.

By a petition circulated in September among the landowners on whose land the birds were to be released, over seven thousand acres of the most suitable pheasant lands in the entire valley were reserved. Every signer has been helpful and cooperative in every respect, being very proud to have this game bird introduced into the valley.

There is no reason why the pheasant will not prosper in Antelope Valley. There is an abundance of food and above all, wonderful cover. The justice of the peace of Antelope Valley states, "Woe be unto the man who molests one of these birds."

The Nevada Fish and Game Commission brought the pheasants from Reno to

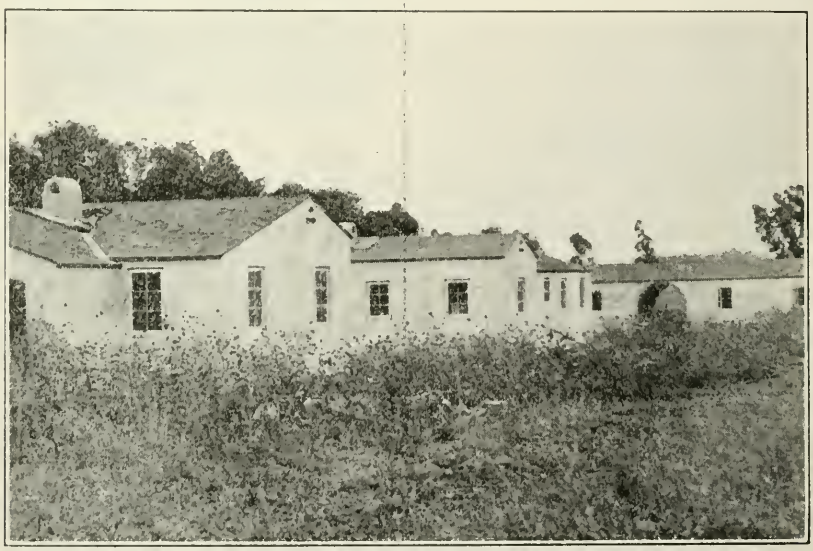

FIG. 55. Buildings for help and the incubator house, all of Spanish architecture at the new Serranos Game Farm, at Chino.

Minden, and Henry Achison of the Forest Service brought them on into Coleville. They, too, deserve a great deal of thanks for their splendid cooperation.

CONFISCATED GAME

When hunters and fishermen are found with game birds, animals or fish in their possession contrary to the game laws of the state, wardens making arrests are empowered to seize the illegal kill. After the material has been held as evidence in the trial of the violators, the seized evidence, if in condition to be used, is at once given to those organizations where it will do the most good.

A large quantity of illegal game was seized during January 1930. Included was 935 pounds of deer meat. Another important item was wild duck, with a total of 457 birds being taken from hunters.

A total check of the fish and game taken from those who had it in their possession illegally shows that, besides the venison and waterfowl above noted, 294 lobsters, 1 pheasant, four cottontail rabbits, 19 quail, 195 nongame birds, 471 abalones, 348 Pismo clams, 1 dove, 108 crabs, 53 jacksnipe, 25 trout, 80 pounds of steelhead and 2 striped bass were seized. In value these donations to charity amounted to $1,527.80 in January alone.

SEEK PROTECTION FOR BALD EAGLE

Many a visitor to California has been thrilled by the sight of a bald eagle perched on a crag of one of the coastal islands. Likewise, the summer vacationist has been thrilled by the fishing activities of a bald eagle in some high mountain lake. Such thrills, however, are becoming of rare occurrence. Bird students now fear the actual extinction of this notable bird.

Senate Bill 2908, by Senator Peter S. Norbeck, and House Bill 7994, by August H. Andresen introduced in congress January 6, 1930, have the endorsement of the National Committee on Wild-Life Legislation.

Each bill reads:

"*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled*, That it shall be unlawful for any person to kill or capture any bald eagle (commonly known as the American eagle) within the continental United States, Alaska, Porto Rico, or Hawaii, or to disturb or destroy any nest, or egg or eggs of such species of eagle found therein; *provided, however*, that it shall not be un-

FIG. 56. Pine Marten, one of the fur bearers, the take of which is diminishing from year to year. The average price of pelts taken last trapping season amounted to $14.50. Photograph by E. P. Steen, January 10, 1929, Huntington Lake, California.

lawful to kill any such eagle or eagles within such area when in the act of destroying wild or tame lambs or fawns, or foxes on fox farms.

SEC. 2. Any person who shall violate any of the provisions of this act shall be subject to a fine of $100 or confinement in prison not to exceed sixty days, or both.

SEC. 3. This act shall be known by the short title 'Bald Eagle Protection Act.' "

Sentiment alone should have been sufficient to protect this noble bird. Certainly, it will be strong enough to assure the passage of a bill now before congress, approved by the National Association of Audubon Societies, which will afford full protection to the bald eagle throughout the United States and Alaska. It is surprising that so worthy a measure has been so long delayed.

CALIFORNIA'S TAKE OF FUR-BEARING ANIMALS

Ever since a trapper's license law was enacted, a computation has been made of the annual take of fur bearing mammals. As was to be expected, the compilation for 1928–29 indicates a marked decrease in both take and valuation. At least one reason for smaller figures during the past year is to be found in the change in the law which took all protection from fur bearers in the great central valley.

As indicated in the figures more than 64,000 less animals are reported and the income to the state has dropped nearly $200,000. Average prices ranged higher the past year on skunk, foxes, mink, ringtailed cat, badger, weasel, river otter and fisher. It is interesting to note the dwindling numbers of those rare fur bearers, the fisher and wolverine. Whereas twenty-nine fishers were reported two years ago, but seven are recorded for the past year; the wolverine no longer appears in the report.

It should be noted that minors under the age of 18 years are not required to take out a license, nor are there records for furs taken for private use or those killed in predatory animal campaigns.

THE NEW LOS BANOS REFUGE

My impression of the Los Banos Refuge at first was rather disappointing, and it is only after spending several weeks in close contact with the property that I have been able to realize something of the value of these 3000 acres as a game refuge, and their possibilities for development. Water is plentiful, being

SUMMARY—FUR-BEARING MAMMALS

Seasons 1927-28 and 1928-29

Species	Estimated number		Average price		Estimated value	
	1927-28	1928-29	1927-28	1928-29	1927-28	1928-29
Skunk	56,438	39,407	$1 56	$1 68	$88,269 03	$66,203 76
Raccoon	19,182	10,758	5 47	5 00	105,002 27	53,790 00
Fox (gray)	14,242	10,751	2.50	2 91	35,661 97	31,285 41
Muskrat	24,736	10,262	70	49	17,537 82	5,028 38
Wild cat	12,250	8,401	2 82	2 22	34,655 25	18,650 22
Coyote	13,941	8,021	6 45	5 81	89,947 33	46,602 01
Civet cat	9,425	5,788	63	60	5,994 30	3,472 80
Mink	5,854	2,751	7 78	8 50	45,555 83	23,383 50
Ringtailed cat	4,368	2,486	3 28	3 41	14,331 41	8,477 26
Opossum	2,208	1,196	78	66	1,735 49	789 36
Kit fox	844	1,098	2 36	2 60	1,996 90	2,856 80
Badger	1,216	916	2 14	3 24	2,605 89	2,967 84
Weasel	661	452	91	93	606 80	420 36
Marten	495	448	15 30	14 50	7,574 49	6,496 00
Beaver	700	431	14 09	13 23	9,867 90	5,702 13
Bear	239	146	6 93	4 16	1,657 47	607 36
River otter	163	101	17 74	18 63	2,891 95	1,881 63
Red fox	123	51	6 48	18 60	798 15	948 60
Mountain lion	88	37	12 85	12 06	1,131 06	446 22
Fisher	29	7	39 28	42 86	1,139 15	300 02
Totals	167,202	103,508			$468,960 46	$280,309 66

	1927-28	1928-29
Number of trapping licenses issued	5,243	6,482
Number of trappers reporting	3,402	3,652
Per cent reporting	64.9%	56.3%

supplied from a generous ditch along about two miles of the west boundary. Then there are a number of natural watercourses, some of which are used as spawning grounds for salmon. The land also contains a number of lakes and ponds, extensive areas that can be easily ditched and made into resting and feeding grounds. There are also numerous swales and sloughs that are inviting to the nesting birds. Considerable of the land is suitable for the production of grain and other crops for feed—the grain to be harvested or the fields flooded and left to the birds. There is a great deal of natural feed which has held thousands of ducks this season. On shooting days 150,000 to 200,000 ducks could be seen on one of the larger ponds at one time. One slough running through the property has held upward of 10,000 green-winged teal at a time. Geese and cranes find plenty of pasturage and a safe retreat. Swan have been seen daily upon the ponds, where 146 were counted, 36 of which were young birds. One day over 300 Ross Snow geese settled down just above my blind; other Snow geese were present every day by the thousands, and a lesser number of Hutchins, Cackling, and Canada geese.

I saw many winged birds, and many with crippled legs about my photographic blinds where I had the ground baited.

This refuge is certainly a move in the right direction, and something that every sportsman should be interested in seeing developed.—E. S. Cheney.

SERRANOS GAME FARM DEDICATED

The formal dedication of the new Serranos Game Farm at Chino occurred on December 8, 1929, with an impressive ceremony and barbecue. The Izaak Walton chapters of southern California provided a program of events stimulating to the sportsmen and lover of the out-of-doors. Many fine trophies donated by the Richfield Oil Company were won as rewards for skill in marksmanship. A special liberation of fifty pheasants was made. Besides officers of the division, I. Zellerbach, president of the Fish and Game Commission; Fred G. Stevenot, director of the Department of Natural Resources, and Ray L. Riley representing Governor C. C. Young, spoke.

The new farm was fully stocked before its dedication with pheasants, quail, partridges and wild turkeys from the Yountville farm, and will participate in production this year.

The land on which the farm situated was donated by the Davidson Investment Company of Long Beach through the generosity of C. E. Davidson.

The location is believed to be ideal for propagation purposes. In its structural features, the farm represents the most improved type of construction. The enclosures are entirely of steel supports permitting galvanized wire to be used to a high advantage from the standpoint of durability. The buildings are patterned after the Mission style so characteristic of California, and comprise, besides com-

FIG. 57. Seining striped bass near Tracy, California, December, 1929, for experimental planting in Salton Sea. This is typical of the work of the Bureau of Fish Rescue and Reclamation. Photograph by George Neale.

fortable living quarters for the attendants, an incubator house and rooms for storage and preparation of food. The same type of sprinkling and watering system which so materially aids efficient operation at the Yountville Game Farm is used. The electric incubator and brooding system, considered impractical until proved successful at the Yountville farm, is also to be employed. In short, the farm embodies in almost every detail the latest advancements and improvements in the field of game bird production.

IT IS UNLAWFUL TO KIDNAP FAWNS

Despite repeated warnings issued by the Division, persons seem to feel the urge to "save" some "poor little abandoned fawn" and insist on picking it up and taking it home. It is a violation of the game laws to do so. Recently a resident of Sacramento Valley paid a fine of $50 for taking a fawn.

Persons who come upon fawns which look emaciated and as though they have been abandoned by the mothers must realize this is their natural appearance. A mother deer never abandons her young and often is away foraging for food, watching from a concealed spot while the baby deer is taken.

All persons are warned not to take fawns. In case they feel the fawn has lost its mother, the thing to do is fix the location in one's mind and notify the nearest game warden or forest ranger, who will see that the little animal is taken care of.

CALIFORNIA QUAIL SELECTED AS STATE BIRD

The campaign to select a state bird has been closed. The California Audubon Society and the Audubon Association of the Pacific, two organizations most active in promoting balloting, have announced votes totaling in the hundred thousands. School children were urged to study birds in order that they might vote intelligently. Women's clubs studied birds in order that they might cast a ballot. No finer campaign of education has been waged in recent years. The California valley quail led a scattered field with western bluebird, Bullock oriole and Anna hummingbird trailing.

In view of the discussion as to which variety of quail should be chosen the following statement by a well known old-time sportsman and writer, Y. T. Payne, is pertinent:

"Glad to hear of your success in placing the gamest of all birds on the escutcheon of the state. The *Lophortyx californicus* (the type of the genus) is the only bird in America that is found nowhere else but California. The *Lophortyx californicus vallicola*, a species of the same genus ranges from the Oregon line along the foothills of the Sierras to their southern extremity in Kern County. There they are replaced by another species, *Lophortyx gambeli*, which is found also on the eastern side of the Sierra as far north as Mono County, California. From here it spreads eastward into the desert country of southern Nevada and eastern Utah and thence through northern Arizona and New Mexico. So you see this species is also found in four other states. The *Vallicola*, beginning about the latitude of Monterey County, spreads across the state to the coast, south to the Colorado desert and down the peninsula of Lower California to Cape San Lucas. So it, too, is not a true Californian but enters a foreign country. While the bird you have selected is found nowhere else on earth but in the foothills and valleys of the western side of the Coast Range from about the latitude of Monterey north to the Oregon line. Therefore the *Lophortyx californicus* is a real native son, so proud of his birthplace that he has never yet left the state except in captivity. Therefore, I think I can say without fear of successful contradiction, that if this bird is adopted as the state bird, California will have the distinction of being the only state in the Union to adopt a bird that can not be found outside of its geographical boundaries."

ESTABLISHMENT OF QUAIL REFUGES URGED

It has been demonstrated that the territory for several miles surrounding small inviolate quail sanctuaries or refuges will become stocked each year provided that water and food for the birds has been developed and the law enforced.

The solution of the problem of how to restock the game fields of the state with valley quail may lie in the establishment of small quail sanctuaries on every farm —large or small—in every county inhabited by valley quail within the state, where all hunting and shooting at any time of year be absolutely prohibited.

It is believed that by the establishment of numerous small quail sanctuaries as outlined many acres of suitable quail habitat within the state can be restocked with valley quail within three years from the nucleus of wild quail already in the field.

Volunteer deputies of the Division of Fish and Game have been asked by Captain Walter Welch to take an active part

FIG. 58. Rescuing small striped bass from irrigation ditch for use in stocking Salton Sea, one of the outstanding accomplishments of the Bureau of Fish Rescue and Reclamation. Photograph by George Neale.

in seeing to it that at least one quail sanctuary is established on some farm in his locality this year.

DEER DAMAGE TO BE INVESTIGATED

Constant reports from many parts of the state that deer are causing damage to the crops of agriculturists has caused the Division of Fish and Game of the Department of Natural Resources to appoint Gordon True, a graduate of the University of California, Department of Agriculture, to prosecute an investigation of ways and means to protect the interests of farmers.

The work of investigating conditions will be carried on throughout the state. The kind and nature of the damage will be studied. Every known device which will serve to keep deer out of cultivated areas will be tried. A thorough test of all known repellents to wild animals, used in this state and in other states, will be made. Both those that act as a deterrent because of odor and those effected because of taste will be tried.

Mr. True will cooperate with landowners who are faced with serious difficulties growing out of abundance of deer and their activities in relation to farm crops. It is highly probable that some landowners have already devised workable schemes to prevent damage and repel the deer.

Included in this investigation will be studies of the diseases of deer. Of particular importance will be the studies of the parasites of deer in order to determine what relationship, if any, exists between deer parasites and those of domestic animals. Lung worm is a dangerous disease of sheep and of deer as well, but whether the same parasite is concerned has not been determined. In this research work, Mr. True will work under the direction of Professor William B. Herms and will use the laboratories of the Parasitology Department of the University of California at Berkeley.

DUCKS IN SAN DIEGO COUNTY

San Diego County has greatly increased water areas by the building of large impounding dams in various mountain canyons. As a result, there have been artificially formed attractive loafing places for waterfowl. With the construction of these lakes has come added sport in waterfowl shooting. For a number of years the supervisor of the San Diego Water Impounding System has required a census of the birds killed.

The census for the past season published in the San Diego *Union*, February 16, 1930, indicates that the total killed for the open season 1928–29 was 53,906 ducks and 7146 mudhens. During the open season of this year, the total amounted to 41,765 ducks, 10,353 mudhens and 11 geese. These totals represent only the birds actually counted and are not complete as some hunters who do not hire

bouts succeed in leaving without filling in the blanks.

Ducks in order of their abundance were ruddy, 23,135; canvasback, 5520; bluebills, 5198; pintail, 3822 and widgeon, 1430. The golden-eye duck, the gadwall and the cinnamon teal each number less than 20 for the season.

A tabulation of the number of hunters whose kill was checked shows 10,082 for the season 1928–29, and 8410 for the season 1920–30.

The smaller take for the past open season is partly explained by a 15-bird duck limit imposed by a city ordinance, and limitation of shooting to three days per week.

THE LIMIT OF TRUE SPORT

Theodore Hoover, brother of the president, a professor at Stanford University, is a thoughtful sportsman as is evidenced by the following quotations from an article detailing some objectives of a sound conservation policy which appeared in *Associated Sportsmen* for January, 1930. Mr. Hoover sets a limit "as above which will be true sport."

"The present situation represents the efforts at conservation of the state and the sportsmen over some twenty or thirty years. Hundreds of thousands of dollars have been spent yearly in hatching, distribution and other measures, and it is a wise thing for us at the present juncture to examine critically and calmly just what this very large expenditure of time, labor and money has produced. * * *

"Now what can one propose as a decent objective in the line of a day's sport as distinguished from child's play? I have given this considerable thought and have come to the conclusion that for myself the absolute limit where I would draw the line between sport and child's play would be at a minimum of ten 10-inch fish or fifteen 8-inch fish.

"Others might be content with less and still consider it sport, and perhaps under all the circumstances if we say the practical objective of any sound conservation policy should be a minimum of fifteen 6-inch fish we will be setting a limit which can be obtained without straining the possibilities. I have fished in South Africa, New Zealand, Norway, Finland and England, in all of which countries our steelhead rainbow (*Salmo irideus*) and our closely related inland variety of rainbow (*Salmo shasta*) have been introduced. There the practical result of conservation is much higher than any ideal here suggested. You can have a better day's sport within fifty miles of New York City than you can find within 200 miles of San Francisco. Therefore it does not seem to me an impractical dream to set a limit as above which will be true sport.

"California advertises itself as the land of the great out-of-doors. We invite the world to come here and enjoy our climate, our parks and our sport. Our climate is as good as it was in the beginning; our parks are improving as the years go by; but our sport is in a steady decline, and we should either take what measures we can to bring it back to a decent standard or cease to advertise it; moreover, our difficulties are sure to increase as the years go by, for we contemplate ten million people living in California within twenty years, besides the visitors.

"Any real effort to bring our trout fishing back to an acceptable standard is not a task of small size. It will take all the resources at our command. It will require a lot more money than we now put into conservation and sooner or later we must come to a realization of that fact if we are to have any angling worthy the name in the future.

"In order to have good sport we must place our fish and game conservation policy on a thoroughly rationalized basis where the first item in our program is a sound plan of scientific research. We are simply deceiving ourselves if we imagine we can carry on this highly technical conservation function with "rule of thumb" methods based on theories built up on the imaginings of us sportsmen and even less capable observers. The sportsman is a keen observer, but he is not accurate and he generalizes from too few observations. The only evidence needed of his inaccuracy is the well-known fact that if there are five fishermen in a room discussing the habits of the trout we will have at least two fights and maybe three going on at once within half an hour after discussion begins."

WINTER FEEDING OF GAME BEGUN

Heavy snows throughout many sections of California during January caused the Division of Fish and Game to issue word to all sportsmen of the state to report at once any cases of failure of food supply for game birds and animals to the nearest deputy fish and game commissioner.

In many places deer, quail or other game birds or animals faced starvation because the available food supply was covered with snow. In Modoc County many birds were found dead. Consequently man power and finances were immediately made available for the purpose of taking care of the situation. Several hundred dollars were spent for food, and wardens and others helped in spreading feed.

Not since the severe storms and heavy snowfall of 1915 has any very general demand been made upon the Division of Fish and Game for the care of game birds and animals. During that season it became necessary to provide hay for deer in many parts of their range, where natural feed was covered by the snows. At lower elevations, where the snow was not so deep, but too deep for the quail to be able to forage for themselves, grain was provided by interested sportsmen and the deputy fish and game commissioners.

Captain E. H. Ober of Big Pine has rendered a report concerning recent work in connection with feeding quail which faced starvation following a recent heavy snowfall in Owens Valley:

"A snow storm of unusual magnitude drifted into District 4¾ January 9th and

continued intermittently during the three following days. Exceedingly cold weather accompanied the snow as the thermometer dropped down to zero throughout Owens Valley for several nights. The fall of snow, however, through the eastern high Sierras could be spoken of as being somewhat freaky as little snow fell in the higher mountains compared to the lower valleys. The extreme lower end and the middle sections of Owens Valley received the heaviest snowfall, which made it necessary to feed quail around Lone Pine, Big Pine and west of Bishop. This work was carried on for several days and good care was furnished upwards of 1000 valley quail. Our practice of feeding was to scrape off the ground clear of snow or ice for twenty or thirty yards each way near, if possible, to willow or tree protection. Then cracked corn or wheat was scattered twice a day. Deputies Crocker and Talbot assisted in this work. In all of our efforts connected with patrolling and feeding of quail, we have never run across any of the Hungarian partridges that were liberated in the valley last summer.

"The mountain quail have been brought down to the lower foothills due to the snow, but have in no way experienced particular hardships. Deer continue to be more plentiful along the lower reaches of the Sierras than for years back. Many have crossed east to the White Mountains. Ringneck pheasants are plentiful throughout Owens Valley, particularly around Bishop and Round Valley. Our recent snow storm has afforded us a chance to take stock of these birds and it is most gratifying to report hundreds of them scattered throughout the valley."

NEW SPEED BOAT

At the special instance and request of the Fish and Game Commissioners, the new speed boat, used in the patrol work by the volunteer deputies of the Division of Fish and Game, has been named the "Walter R. Welch," in appreciation of the activities of that individual in the service of conservation.

In 1896 Walter R. Welch affiliated himself with the Fish and Game Commission as a volunteer deputy. In 1901 he became a regular deputy for the state organization. In 1926, when the reorganization of the volunteer deputies was brought about, Welch was made Captain, in charge of this group, a position which he still occupies.

HUNTING LICENSES

According to a late compilation of the number of hunting licenses and income therefrom for 1927–28, California ranks fifth in number of hunting licenses and fourth as to income. The figures for New York and Indiana included angling licenses and are therefore not considered. Pennsylvania ranks first with 517,729 licenses bringing in an income of $1,006,159.70; Michigan and Ohio are not far apart in the number of licenses sold, but in income Michigan is more than $150,000 ahead. Only one other state has more than $300,000 income from the sale of hunting licenses and that is Illinois.

California's total for 1927–28 was 228,696 licenses bringing in a revenue of $464,145.

THE LATEST BIRD BANDING EXPERIMENT

On February 16 and 17, 1930, a liberation of sixty-seven pintail ducks from Louisiana was made on Winter's Island, a well equipped duck club on the Suisun Marsh. The object of this liberation of banded birds is to determine whether they will find their way back to the east coast in subsequent migrations or whether they will stay on the west coast and be shot later by local shooters.

The members of the Winter's Club cooperated with the United States Bureau of Biological Survey and George Tonkin, federal game warden for the district of California in liberating these banded birds from the gulf coast. The ducks were taken on the McIlhenny refuge at Avery Island, Louisiana. Records have already shown that western ducks occasionally spend the winter on the gulf coast.

HERE'S THE PROPER TERM TO APPLY

It is common these days to hear a man talking about bunches or coveys of ducks, geese or other wild fowl. As this is entirely wrong, it is worth while to recall the correct names of different gatherings of birds:

A bank of swans.
A bunch of widgeon.
A brood of grouse.
A bevy of quail.
A band of jays.
A coil or spring of teal.
A covey of partridge.
A crowd of redwings.
A fall of woodcock.
A fleet of coots (mudhens).
A flight of plover.
A gaggle of geese.
A paddling of mallard.
A rafter of turkeys.
A sedge of herons.
A tribe of sparrows.
A whisp of snipe.

—William W. Richards, *Pacific Sportsman*, Vol. VIII, no. 3, May, 1929.

MUSSEL AND CLAM QUARANTINES LIFTED

Because of the appearance of a large number of cases of poisoning caused by eating mussels gathered along the California coast, quarantine was established on July 22, 1929, under which the sale or offering for sale of all mussels gathered on the California coast from Monterey County to Del Norte County, inclusive, was prohibited. Because of the appearance of cases of poisoning due to eating clams gathered in San Mateo, Sonoma and Marin counties, similar prohibitions were placed August 6th and 9th upon the territory covered by those three counties.

On November 2d all of these quarantines were terminated because examinations of clams and mussels gathered in the quarantined area showed that their toxic condition had disappeared or had become so low that it was harmless to human beings.

A total of fifty-five cases of poisoning due to eating mussels occurred during the past summer season. Only one of these cases was fatal. Six cases of poisoning due to eating clams occurred during the same period, three of which cases were fatal. It would appear that these shellfish become toxic each year, particularly during the summer months. This fact will probably make necessary the annual issuance of quarantine orders on both clams and mussels gathered along certain sections of the coast line of California. These shellfish become less toxic after the summer season has passed, and it is believed that they are absolutely harmless to human beings, generally, during the period November 1st to March 1st.—*Weekly Bulletin*, California Department of Public Health, December 7, 1929.

COOPERATION IN LAW ENFORCEMENT

A number of counties of the state hire game wardens whose duty it is to help enforce the state laws protecting fish and game. The most notable cooperation of this kind comes from Los Angeles County where a county forester and fire warden and a large group of deputies aid greatly in enforcing state game laws. A recent compilation shows a marked increase in numbers of cases made by Los Angeles County game wardens. Though in the year 1920 but a single arrest was made with a resultant fine of $15, the total for 1929 showed 90 arrests, 82 convictions and $2,770 in fines actually paid. The total number of arrests for the period amounts to 1193. The illegal possession of abalones caused the arrest of 364 men, whereas hunting without a license got 108 men into trouble.

Fines and Arrests Made by Los Angeles County January 1, 1920, to January 1, 1929.

Calendar year 1920--	
Arrests ---------- 1	
Fines paid ----------	$15 00
Calendar year 1921—	
Arrests ---------- 25	
Convictions ---------- 23	
Fines paid ----------	$295 00
Fines suspended----------	1,525 00
Jail sentences served-----	none
Jail sentences suspended-	10 days
Calendar year 1922—	
Arrests ----------191	
Convictions ----------187	
Fines paid ----------	$3,082 50
Fines suspended ----------	425 00
Jail sentences served -----	33 days
Jail sentences suspended--	610 days
Calendar year 1923—	
Arrests ----------193	
Convictions ----------178	
Fines paid ----------	$8,010 00
Fines suspended----------	505 00
Jail sentences served-----	150 days
Jail sentences suspended--	1,850 days
Calendar year 1924—	
Arrests ----------219	
Convictions ----------194	
Fines paid ----------	$5,300 00
Fines suspended ----------	800 00
Jail sentences served-----	none
Jail sentences suspended--	1,173 days
Calendar year 1925—	
Arrests ---------- 88	
Convictions ---------- 77	
Fines paid ----------	$6,185 00
Fines suspended----------	745 00
Jail sentences served-----	210 days
Jail sentences suspended--	1,125 days
Calendar year 1926—	
Arrests ---------- 73	
Convictions ---------- 66	
Fines paid ----------	$1,780 00
Fines suspended ----------	790 00
Jail sentences served-----	5 days
Jail sentences suspended--	105 days
Calendar year 1927—	
Arrests ----------206	
Convictions ----------193	
Fines paid----------	$4,487 50
Fines suspended----------	4,195 50
Jail sentences served-----	5 days
Jail sentences suspended-	142 days
Calendar year 1928—	
Arrests ----------107	
Convictions ----------102	
Fines paid ----------	$6,522 00
Fines suspended----------	1,505 00
Jail sentences served-----	240 days
Jail sentences suspended-	none
Calendar year 1929—	
Arrests ---------- 90	
Convictions ---------- 82	
Fines paid ----------	$2,770 00
Fines suspended----------	1,465 00
Jail sentences served----	37 days
Jail sentences suspended-	487 days
Totals, calendar years 1920 to 1929, inclusive—	
Arrests ----------1,193	
Convictions ----------1,103	
Fines paid ----------	$38,447 00
Fines suspended ----------	11,955 50
Jail sentences served-----	680 days
Jail sentences suspended-	5,502 days

List of Fish and Game Cases January 1, 1920, to January 1, 1929

Hunting without license----------	108
Fishing without license----------	32
Hunting without deer tags----------	5
Hunting at night----------	23
Shooting from power boat----------	2
Firearms in game refuge----------	53
Shooting game from auto----------	14
Trespass posted property----------	35
Illegal deer hides----------	8
Illegal deer meat----------	61
Killing spike buck----------	24
Killing doe ----------	18
Killing fawn ----------	10
Failure to retain deer head and hide-	4
Killing deer in game refuge----------	2
Killing deer out of season----------	28
Failure to tag deer----------	1
Running deer with dogs----------	2
Killing tree squirrels----------	3
Killing nongame birds----------	35
Killing wild pigeons----------	6
Killing cottontail rabbits----------	2
Killing waterfowl on illegal day-----	1
Undersize crabs ----------	1
Undersize Pismo clams----------	11
Overlimit Pismo clams----------	17

Overlimit trout	21
Selling trout	1
Out of season trout	2
Illegal black bass	10
Overlimit black bass	1
Out of season black bass	3
Catch black bass with net	9
Illegal lobsters	46
Out of season lobsters	4
Illegal abalones	364
Overlimit abalones	65
Using abalones for bait	21
Spearing abalones	2
Selling corbina	1
Selling spotfin croaker	1
Illegal pheasants	1
Out of season doves	19
Overlimit doves	12
Out of season ducks	33
Overlimit of ducks	1
Out of season quail	41
Selling quail	2
Trapping quail	3
Purse seining	23
Operating boat without license	1
Total	1193

IMPORTATIONS OF GAME BIRDS

Much interest has been displayed during the past two or three years in the importation of Hungarian partridges. Since this species has been successfully established in several western states, others have sought to obtain breeding stock to build up their game resources. New York has been particularly active in this respect, and during the year has received several large shipments. The supply of birds is obtained chiefly from Czechoslovakia and Hungary, and the demand has been so great as to cause apprehension as to the source of supply. Early in the year shipments from Czechoslovakia were suspended for a time because of the disastrous effect of the cold winter on the stock of native birds. In addition to exporting 90,000 to 100,000 dead partridges annually, Czechoslovakia exports a large part of the live birds entered in the United States, England and Switzerland. Many of these birds are bred solely for the export trade, and the prices vary from $1.75 to $2.94 each, to which is added a 25 per cent ad valorem export fee. Several shipments of pheasants were imported from Europe, chiefly to introduce new blood into the stock in the United States. A limited number of grouse, chiefly ruffed and sharp-tailed grouse, were entered from Alberta, and nearly 500 diminutive button quail (*Excalfactoria lineata*) from the Philippines and Australia, and 40 tinamous (*Nothura maculosa*) from southern South America. —Report of the Chief of the Bureau of Biological Survey, August 30, 1929.

EXPERIMENTS ON INCREASING BIRDS ON THE FARM

The experiments in attracting birds to the experimental chestnut orchard at Bell, Maryland, being carried on in cooperation with the Bureau of Plant Industry, continue to yield good results from year to year. In 47 bird boxes erected on a tract of 2½ acres there were produced during the season of 1926, 17 partial or complete broods to the acre. In 1927, with the same equipment, the number of broods rose to 40, an average of 16 to the acre. In 1928, 52 additional bird houses were erected, making a total of 99, scattered over 3½ acres, and 65 broods were produced, an average of 18.5 to the acre. The kinds of birds and the number of broods of each in 1928 were as follows: house wren, 33; European starling, 9; English sparrow, 8; purple martin, 7; bluebird, 6; flicker, 1; and crested flycatcher, 1. This cooperation with the Bureau of Plant Industry is enabling the bureau to experiment in bird-attraction methods and is yielding valuable information in that field, as well as fulfilling the primary object of the studies—from the point of view of orchard management—namely: to increase the number of insectivorous birds in the locality.—Report of the Chief of the Bureau of Biological Survey, Aug. 30, 1929.

ECONOMIC VALUE OF PREDATORY ANIMALS AND BIRDS TO BE STUDIED AT STATE UNIVERSITY.

Decision has been made by the Bureau of Education and Research of the Division of Fish and Game to prosecute an investigation into the food habits and economic relations of those birds and animals considered destructive to game in order that one resource may not be saved at the expense of another. The science laboratories and other facilities of the University of California will aid in the investigation planned.

It is the duty of the Fish and Game Commission adequately to care for the fish and game resources of the state. One of the first resources that was utilized was that of the fur-bearing animal. Search for suitable trapping grounds first brought the white man to the western state. However, as a resource, the fur-bearing animal has dwindled. Numerous adverse factors are concerned. Among them is the cultivation of land and the ever present demand of the cattleman and sheepman to control predatory species. Organized groups of sportsmen join in asking for campaigns of destruction. There is opposition to a program of protection. In contrast to this viewpoint is that of many a scientist who maintains that the predatory animal has a real place in nature and that its destruction

endangers the success of other animals in the forest. Stomach examination of black-listed forms has shown them to be valuable as rodent destroyers and practically innocuous to game birds. Additional research is needed before these animals can be evaluated.

When an attempt is made actually to line up facts to support either of the above contentions, they are hard to find. There is much loose talk on both sides of the controversy. Scientific and economic values are not as yet well known. As a consequence, the Division of Fish and Game is planning research to gather facts helpful in deciding whether the depredations of predatory animals warrant campaigns of destruction or control by letting the trapper harvest an annual crop. Likewise more information will be gathered on the relation of hawks to game birds.

Arrangements have been completed with the University of California to direct an investigation to determine important facts relative to predatory animals. E. L. Sumner, Jr., has been employed as a Research Fellow to prosecute the investigation. He will work under the direction of Dr. Joseph Grinnell, director of the Museum of Vertebrate Zoology.

The study will include:

(a) Detailed first-hand investigation of life histories of various species with special reference to their methods of feeding.

(b) Intensive study of a particular species, which will be emphasized above others in order to direct and conserve time and energy efficiently. This intensive study to be supplemented and enlarged upon by findings relative to other species.

Of prime importance will be a study of the interrelations of these animals to other species. Such interrelations will be determined by making studies of the methods by which these animals secure their food; by taking censuses on a given area showing ratio of number of individuals to number of animals upon which they prey; by study of seasonal changes in food habits as dictated by changes in food supply; by study of conditions resulting in regions where these animals have been greatly reduced in numbers; and by estimates of normal food consumption of species studied.

The attempt will be made to gather dependable data that will prove or disprove the truth of the statement made by some zoologists that "predatory" animals play an important part in preserving the balance in nature and that their extermination produces results harmful rather than beneficial to the species upon which they prey.

If this can be done, one of the most mooted questions connected with game conservation will be solved.

WESTERN FISH SURVEY PROPOSED

At a meeting of the game officials of Wyoming, Montana, Utah, and Idaho at Yellowstone National Park on July 17 and 18, it was proposed that congress make provision by appropriation for a survey of the streams of the Rocky Mountain region of the United States to determine what varieties of fish are suitable for each stream and what is needed to be done to provide an adequate food supply in each. Congress will undoubtedly be asked at the coming session to make such an appropriation.

Participating in the conference were representatives of the National Park Service, the U. S. Forest Service, the U. S. Biological Survey and the U. S. Bureau of Fisheries.—American Protective Association News Service.

NON-PROOF FENCES FOR DEER

Barbed wire, the mark of the homesteader on the frontiers of the old West, marked the beginning of the end for the great herds of buffalo. Wire fences still present a problem in game management in California.

Through the cooperation of the Division of Fish and Game of the Department of Natural Resources and the Southern Pacific Company the latter organization is experimenting with a plan to prevent deer, during their migrations across Modoc County, where a new railroad right-of-way has been opened up, from becoming entangled in the mesh of a fence along the right-of-way.

A strip of country some eight miles in length, between Ambrose and Boles, has been the subject of much complaint, with numerous cases being reported of deer having been killed or crippled by being caught in the wire fence along the railroad right-of-way. The solution of the problem, according to the consensus of opinion, is the placing of a board along the top wire of the fence, thereby marking the obstacle so that it can be seen by the migrating animals.

If the plan proves successful, the Southern Pacific Company has indicated that the practice will be extended to the fences of the company for the entire distance where injury to animals has been reported.

REGULATIONS UNDER WHICH COMMERCIAL DUCK CLUBS MAY BE OPERATED.

General Order No. 9

Regulation No. 1

Shooting days limited to three days a week: Sunday, Wednesday and Saturday. Additional operating days, the opening and closing of the season and all legal holidays.

Regulation No. 2

A blind must be within shooting distance of water. Blinds must be a reasonable distance apart, to depend upon local conditions.

Regulation No. 3

Each shooter must be given a satisfactory blind. No shooters to be allowed to hunt at large when blinds are full.

Regulation No. 4

Must cooperate with the Fish and Game Commission in law enforcement.

Regulation No. 5

Where clubs adjoin, no blinds to be located within 70 yards of adjoining boundary, except under mutual agreement.

Regulation No. 6

The continual shooting at birds out of range will be regarded as a nuisance and the club may at its discretion, refund the money paid for shooting privilege and bar shooter from further hunting.

Regulation No. 7

Under no consideration is a club to guarantee limit.

The foregoing order is hereby approved and ordered filed as "General Order No. 9, Division of Fish and Game, of the Department of Natural Resources of the State of California."

Dated: This 30th day of September, 1927.

I. Zellerbach,
Reginald Fernald,
Geo. B. Clarkson,
Fish and Game Commission.

VALLEY QUAIL HUNTERS FIND BIRDS SCARCE

The 1929 season on valley quail closed on December 31. Unfavorable reports were received from many parts of the state. Birds were reported as scarce and few limits were secured. The scarcity of birds last year came after several successful seasons which seemed to indicate that the shorter open season in the middle

Fig. 59. Up and over. A steelhead trout jumping the fishway at Snow Mountain Dam on the South Eel River. Photograph by E. S. Cheney, February, 1930.

of the winter with the aid of several successful breeding seasons had really brought this favorite game bird back to satisfactory numbers. The usual reason given for the poor season last December was "drought conditions." Few birds are more subject to marked fluctuations in numbers than are the upland game birds.

A few successful breeding seasons increase numbers to a maximum, whereas an unfavorable season reduces birds to a minimum. It has often been reported that in dry seasons, flocks of quail do not separate out into pairs, but remain in flocks throughout the breeding season. Though there were not many reports of this kind last summer, the scarcity of quail this past winter certainly indicates a poor breeding season last spring.

THE CHUKOR PARTRIDGE

Within the past few years a number of Chukor partridges have been imported and various game farmers are now propagating them. Experiments with this bird have received support because of the rather negative results thus far secured in this state with the Hungarian partridge.

Unlike Hungarian partridges they are very easily mated. A male bird can be transferred from one female to another without any trouble and will mate with several in a season. They will stand any amount of heat without discomfort. That was well proven this summer during our hottest spells when the birds sprawled flat on the ground in the hot sun and seemed to enjoy it very much.

These birds came from India, where they are considered to be a very fine game bird. The flesh is light colored throughout. It is not quite as light as our valley quail, but almost. In the birds which I handled there seemed to be a faint pinkish tint. Unlike the Mongolian pheasant which seems to like cultivated areas, this bird would probably take to cover. It is a ground roosting bird, but it will also roost on the perch. Where there are ground enemies, it would probably take to the trees.—W. E. Unglish, Gilroy, California.

VOLUNTEER DEPUTIES

In order to avoid conflict of authority and possible friction, the Division of Fish and Game has found it necessary to adopt a rule whereby it will not appoint any deputy sheriff, deputy constable, or the keeper of a gun club or shooting preserve, a deputy of the Division of Fish and Game.

Deputies of the Division of Fish and Game are vested with the highest authority of any public officer of the state, viz, that of the right to search buildings, other than dwellings, and all receptacles, other than the clothing actually worn by a person at the time of the search, where there is reasonable reason to believe that fish or game is illegally held or had in possession. In the exercise of this authority all volunteer deputies are advised to use the word "inspect" instead of "search." The volunteer deputies are advised not to search any market place, cold storage plant, hotel, or other building, or ice box, except under the direction, supervision or approval of the regular deputy or the captain of the regular patrol of the district.

The volunteer deputies are advised not to make arrests for technical violations of the law. The deputy must be able to prove that the spirit and intent, as well as the letter of the law, has been violated before he can expect to convict the person arrested.

Volunteer deputies are informed not to accept any gratuities or privileges from the owners of gun clubs or any other person, and are strictly forbidden to use their authority or badge for the purpose of securing any gratuities or privileges.

Volunteer deputies are appointed on three months probation, and upon their activities during these three months depends their future continuation as deputies.

All volunteer deputies are instructed that under no circumstances shall they accept any money for bail, or any other purpose, from any person that has been arrested by them.

All volunteer deputies are to work under the direction of the regular patrol through a captain and lieutenant—the captain to be elected by the deputies, and the lieutenant to be appointed by the captain.

All captains of the volunteer deputies are elected to serve for a term of six months from the date of their election.

All volunteer deputies who receive information of a violation of the fish or game laws must report such information to the regular deputy, or to the captain of the volunteer deputies, before taking any action on such information.

All volunteer deputies have the authority, and it is their duty to make immediate arrest without a warrant, any person who has committed a violation of the fish or game laws in their presence in any part of the state.

When a volunteer deputy has made an arrest for a violation of the fish or game laws it is his duty to immediately take all the evidence to the regular deputy, or to the captain of the volunteer deputies,

FIG. 60. Another steelhead climbs the fish ladder at the Snow Mountain Dam on the South Eel River. Photograph by E. S. Cheney, February, 1930.

and inform him of all the circumstances surrounding the case. The regular deputy, or the captain of the volunteer deputies will then inform the deputy who made the arrest what further action will be taken in the case and supervise the filing of the complaint against the party arrested.

The captain of the volunteer deputies shall require the deputies under his control to report to him monthly, giving an account of their activities in the field. A summary copy of these reports must be filed by the captain of the volunteer deputies with the association or club sponsoring the appointment of the deputies under his control. Said monthly reports must be filed by the captain, with the captain in charge of volunteer deputies, 510 Russ Building, San Francisco.

It is the duty of the captain of the volunteer deputies to report all information coming to him to the regular deputy and not to take any action on same except under the advice, direction and approval of the regular deputy.

Applications for appointment of volunteer deputies must be signed by the president and secretary of the organization recommending their appointment and be indorsed by the captain of patrol of the district in which the applicant resides. As the secretary of state will require a fee of $5 for filing the bond of each volunteer deputy, said fee of $5 must accompany each application and recommendation for the appointment of volunteer deputies.

Each volunteer deputy will be paid a salary of $5 for his first month's services, to compensate him for bond filing fee. Thereafter his services to be volunteer and without compensation.

All volunteer deputies are advised not to enforce the provisions of section 627 of the Penal Code, which relates to trespass upon private property, or the provisions of any county ordinance, or, in fact, any law except the state fish and game laws. The activities of all volunteer deputies must be confined to the county in which they reside, except in cases where a violation of the fish and game laws has been committed in their presence outside their respective counties, or when they have secured permission to perform special duties outside their respective counties from the field assistant of the Division of Fish and Game or from the captain of patrol of the regular deputies of the district in which they reside.

The efforts of the volunteer deputies should be to build up an active, efficient, harmonious, cooperative body to coordinate with the regular patrol for the enforcement of the fish and game laws and to educate the people as to the value and necessity of such laws. Therefore, the actions of the wardens should at all times be such as to reflect with credit upon themselves and those responsible for their appointment.

PHEASANT BANDING GIVES VALUABLE INFORMATION

How far will pheasants travel? Will pheasants travel long distances when released in good pheasant territory, or do they travel long distances to get into good country?

Answers to these and many other questions are being sought by the department of game of the Wisconsin Conservation Commission by a comprehensive bird banding program. Every pheasant sent out from the state game farm carries an aluminum band upon its leg which bears the inscription, "Notify the Wisconsin Conservation Commission," and beneath this a serial number.

Every bird raised by the game farm is individually card indexed with a complete history of its development and release.

The conservation commission has been obtaining some extremely valuable information regarding the ring-neck pheasants which were released by the state game farm in its first year of operation. In the case of pheasants, even more so than with most birds, little is known as to their range.

The latest return to the Wisconsin Conservation Commission of a band is that of a pheasant hen raised in 1929 at the state game farm, shipped to the Outagamie County Fish and Game Association, and released just north of the village of Kaukauna in Outagamie County. This bird was found dead last week in a sand pit in the heart of Appleton. It had been decapitated but whether by a predatory bird or by what means is unknown. The significance is that the bird had traveled seven miles from the point of release in less than three months.

Further information is needed on the habits of pheasants, and anyone finding a ring-neck pheasant or any other game bird with a band upon its leg, is asked to get in immediate touch with game officials.

LAWS NECESSARY

Man can not live at all in a civilized state without law. It is the cornerstone of civilization. Without it there can be no liberty. Without it there can be no protection of personal and property rights. Without it life itself becomes insecure. Without it there can be no enforced conservation, and there can, under existing conditions, be no general conservation unless it is enforced.

What then should be the attitude of those interested in conservation toward government and toward law? Wouldn't it be a good plan to popularize the government and the laws which we have enacted? Wouldn't it be well to call to mind once in a while that the laws which we have were not handed down to us ready made by any governing king, prince or potentate, but that they are our laws, enacted and kept in effect by us and our representatives? Wouldn't it be well to cease to regard the law, as some now regard it, simply as something which curtails our liberties, something to be avoided if not evaded, and to regard it as the protector of our liberties, the preserver of our peace and happiness, the foundation of our prosperity?

When the American people cease to wink at lawlessness, when the average citizen fully appreciates his duties as such, and decides to take his proper part in the important business of government, the laws will be enforced and crime will decrease, and with a growing respect for all law there will inevitably come a greater respect for laws relating to conservation.—*Outdoor America*, February, 1930, p. 37.

VOLUNTEER PRESS AGENTS

Emphasis needs to be continually placed on the importance of molding public opinion in favor of conservation. Because the press is foremost and all-powerful in shaping the public's sympathies and interests, a column on fish and game in the principal county newspapers of the state supported by the local association of sportsmen would prove very effective in stimulating a greater appreciation for fish and game. California is making a distinguished success of its volunteer warden system which has so ably aided game law observance. Why not, therefore, extend the volunteer conception into the realm of education and have volunteer press agents?

J. H. Neustadt in advocating this plan writes in the *Associated Sportsman* for December, 1929, as follows:

"There is a touch of interest about these personal home doings that arouses the curiosity of all county newspaper readers, and through this familiarity with the subject of fish and game, the public is educated to an appreciation of what is being done, and soon graduates into protectionists and active backers of the officers of the law and sportsmen generally.

"The plan has been practiced by the San Mateo County Fish and Game Protective Association for the past year, and many are the new subscribers who read the fish and game news to their growing children and encourage them to become sportsmen of the true type.

"Every student of human nature knows there is an element of good in

every man, and that good can be brought out by example and education.

"Where there is little knowledge there is little progress.

"I know from experience, as the publicity man of our club, the newspapers want the news, the wardens want the encouragement, and the public only needs the light and understanding of the great meaning of conservation to become supporters of the valuable work."

A NATIONAL WILD LIFE POLICY DRAFTED

During the past year a committee of the American Game Conference of the American Game Protective Association has been at work on the preliminary draft of a wild-life conservation policy. A report was submitted by this committee to the recent sixteenth annual conference held in New York December 2 and 3. The committee, which comprises 15 or more of the leading students of this subject in the country and of which Aldo Leopold, in charge of the National Game Survey, is chairman, submitted a preliminary report at the conference, not as a final result of its work but as a basis of further study. All conservationists, game officials and others who are studying this problem are invited to examine this report carefully and make suggestions as to modifications and improvements.

The report, which is too long to print herein, analyzes the game problem, divides game into four classes and discusses each class and its requirements at length. One recommendation of the committee which covers advanced ground is that for class one, or farm game, consisting of non-migratory species such as quail, pheasants, grouse, etc. There must be an incentive on the part of the landowner in order to guarantee a continuing and increasing game crop. This incentive must be more than sentimental and the committee frankly states that the farmer should be encouraged to grow a game crop by permitting him to charge for the privilege of shooting on his land. But it is specifically pointed out that this privilege should not extend to land which is not managed for game. By raising game on farms it is not proposed to employ artificial methods but to use the natural method of providing cover, food and protection.

Two other alternatives, it is pointed out by the committee, are to be faced; one, outright adoption of the European system for farm game and, two, eventual complete closure of open season on farm game.

Other classes of game which are found in the forests and open ranges and in the wilderness require different treatment and are discussed fully in the report. Migratory game, including waterfowl and shore birds, constituting class four game in the report, appear to be provided for under the system established by federal law including the Migratory Bird Treaty Act, and the Migratory Bird Conservation Act which propose to establish an extensive series of refuges throughout the country. This, according to the committee, is not sufficient, however, to meet the needs of this class of game completely and should be supplemented by the establishment of state and private refuges and the acquisition by the public of all available remaining marshlands. There must be also a vast expansion of fact finding in relation to migratory birds under the leadership of the U. S. Bureau of Biological Survey.

The committee finds that the game restoration program of today is on too small a scale. It is far from commensurate with the needs of existing population and to meet future growth. Knowledge of facts is far from adequate. Research must be greatly extended through cooperation of state universities and other institutions of learning. There must be more trained leaders and workers well grounded in scientific and technical knowledge. The work must be more adequately financed either by increased license fees or some other method.

The preliminary report of the committee was published in full in the transactions of the recent Game Conference and in American Game, the official bulletin of the American Game Protective Association. Those interested in studying this report may obtain information by writing the association at 233 Broadway, New York City.

WHAT IS A SPORTSMAN?

The word sportsman is a much abused term. To the nature lover who would kill no form of wild creature, the term is anathema. To the average gunner, it is any man who goes afield with a gun in search of game.

It has remained for William B. Mershon of Saginaw, Michigan, nestor of American sportsmen, to clarify the term. In a notable address before the recent game conference, Mr. Mershon defined the term. He pointed out that sportsmanship during the passage of the years has changed in technique but not in principle. When this country contained only thirty or forty millions of people and an abundance of game, when firearms were primi-

tive and transportation slow, it was considered sportsmanlike to shoot without limit, provided none of the game was wasted.

Today that is not the case. Vast increase in population, in efficiency of firearms and in rapid transit have made it necessary for more stringent restrictions so that today the true sportsman is not the man who looks upon the size of his bag.

Time was when it was perfectly legitimate to shoot a partridge out of a tree, but no sportsman would now pot a bevy of quail or shoot a duck on the water. Unfortunately, there are gunners who do these things, but they are not entitled to the designation of sportsmen.

With changed conditions we must of necessity raise our standards of sportsmanship in this country.—*Field and Stream*, January, 1930.

PROGRAM FOR ELK PROTECTION

A commission for the conservation of elk in the Jackson Hole region of Wyoming was created during the existence of the president's conference on outdoor recreation. While the conference has ceased to function the elk commission intends to carry on, says an American game protective association news bulletin.

At a recent meeting held in Washington on December 5, 1929, the commission voted to voluntarily continue its activities. The need of the elk which came down from Yellowstone Park to the Jackson Hole for their winter range is enlarged range capacity. The frequent loss of elk in this region from starvation during the winter time is well known and the remedy is well understood. It appears that the Snake River Land Company has acquired some 25,000 acres of land which it proposes to offer to the government for elk range provided an equal amount is secured by congressional appropriation. The refuges now owned by the federal government in that locality for the winter range of the elk are wholly inadequate for the purpose.

A complete program for the administration of the elk is to be worked out through cooperation with the Wyoming State Game and Fish Commission, the U. S. Forest Service, the National Park Service and the Biological Survey.

The elk commission is composed of representatives of the Izaak Walton League of America, the Dude Wranglers Association, the Camp Fire Club of America, the Government of Wyoming, the U. S. Forest Service, the U. S. Biological Survey, the American Game Protective Association, the Boone and Crockett Club and other interested organizations.

BENEFICIAL EFFECT OF FEDERAL LAWS

The federal migratory bird laws and their regulations provided at once a harmony of protective measures, based on zones, times of flight, and relative abundance.

They furnished in a central organization the means for accumulating information relative to the migratory game-bird situation.

They prohibited the commercialization and the spring shooting of migratory game birds, and prohibited also such destructive methods of taking hitherto permitted under the laws of many states, as night shooting, trapping and snaring.

By providing equal privileges in all parts of the country, the federal laws eliminated the dangerous effect of jealousy among gunners in different sections and developed the principle of a mutual interest in a common possession.

However, the establishment of the principle of administration of a national resource by the central government was a strong incentive to increased cooperation among the several states in game-bird protection. The evident common sense, fairness and effectiveness of the principal of federal control arrangement gradually reduced all lingering opposition. The spread of this helpful spirit of cooperation is registered by the fact that forty-five states have voluntarily brought their laws relating to the protection of migratory game birds in harmony with the federal regulations.—From an address by W. C. Henderson, Bureau of Biological Survey, before the Federation of the Bird Clubs of New England, at Boston, Mass., January 16, 1930.

COLLECTION OF LOCH LEVEN TROUT EGGS

The superintendent of the Bozeman, Montana, station has again reported a record-breaking take of loch leven trout eggs at the auxiliary station at Meadow Creek, Montana. These eggs, secured from wild fish running up Odell Creek, have been taken in increasing quantities during the past few years. The total collection for this season, aggregating over 17,000,000, represents the largest number of eggs that has been secured in this field to date. These increases have been based upon a return to parental waters during recent years of the product of not more than 40 per cent of the eggs taken. This fact would seem to indicate that when proper conditions prevail 60 per cent of the potential egg supply to be derived from a population of trout can be diverted to other waters without crippling the

natural production.—*Fisheries Service Bulletin*, January 2, 1930, No. 176.

MUSK OX REFUGE SAFEGUARDED

The Thelon Game Sanctuary, east of Great Slave Lake in the Northwest Territory, which contains the last known herd of musk ox on the Canadian mainland, has been closed. No person, either Indian or white man, will be permitted to enter this 15,000-mile preserve unless by special arrangement. The musk ox is rare, and action has been taken by order-in-council to conserve the herd of approximately 250 known to have their habitat in this area. —*Science*, vol. 70, No. 1823, December 6, 1929.

FISH REFUGES IN WISCONSIN

By the establishment at the last meeting of the conservation commission of 121 fish refuges in twenty-seven counties of the state of Wisconsin, the commission has commenced the work of protecting fish by setting aside areas in which they are safe the same way game has been protected for many years.

Although this idea is new in Wisconsin, it is not new in other states. New York, Pennsylvania, and other states in the east for several years have had fish refuges, which have materially bettered fishing conditions there. In the upper peninsula of Michigan there have been several refuges established. In one instance in the upper peninsula, east of Watersmeet, one whole stream was closed to fishing for several years. People in the upper peninsula respected this order, and although the stream runs for several miles along the road there have been very few violations of the order.

The purpose of establishing fish refuges is to protect the spawning beds and home of infant fish. Establishing trout refuges does not affect fishing at all, as the only parts of the streams which are closed are the very headwaters or the small tributary feeder streams into which big fish go only at spawning time.

The only way refuges can be established in lakes for pike, pickerel, bass, muskellunge, and other lake fish, is to designate a certain area which is known to be either a spawning bed or a lurking place for baby fish. Because spawning beds can not be limited definitely by feet and inches, it is necessary to restrict fishing in an area large enough to be sure of including the spawning beds. Connecting streams between lakes are very frequently favorite places for spawning, and though the entire stream probably is not used by the fish for spawning beds, still the beds are close enough together to make it imperative that the whole stream be closed if the beds are to receive ample protection.—Duane H. Kipp, *Outdoor Life*, January, 1930.

BIOLOGISTS TO STUDY WILD LIFE IN FORESTS

Two research specialists have been appointed to positions in the Bureau of Biological Survey, U. S. Department of Agriculture, effective at the beginning of the year, in accordance with cooperative plans to place qualified biologists at various experiment stations of the Forest Service. These scientists will study the relation of wild life to the forests, as authorized by the recently enacted McSweeney-McNary Forestry Research Act.

Thomas D. Burleigh, for the last nine years head of the division of forestry of the Georgia State College of Agriculture and one of the appointees, has been appointed to the position of associate biologist and will be stationed at the Appalachian Forest Experiment Station, Asheville, N. C. He is a graduate of Pennsylvania State College and the University of Washington. He has devoted considerable time to the study of the bird life of Georgia.

Oliver L. Austin Jr., of New York, a graduate of Wesleyan University and who has done three years' graduate work in Harvard University, has been appointed assistant biologist to carry on studies of wild-life and forest relationships at the Lake States Forest Experiment Station, St. Paul, Minn. He spent the summer of 1925 studying jungle ecology in British Guiana, South America, and has made three trips to Labrador to study the distribution of the vertebrate fauna of the region. On his Labrador trips he did notable work in bird banding, particularly with Arctic terns, in cooperation with the Biological Survey. Two of the terns that were recovered, one in France and another in South Africa, established remarkable flight records, the latter flying the longest distance of any banded bird ever recaptured, as far as any known records show.

DIVISION ACTIVITIES

Bureau of Patrol

During the months of November, December and January 719 arrests were made by the Bureau of Patrol for violations of the fish and game laws. As a result of those arrests, a total of $22,669.50 was collected in fines and jail sentences of 1180 days were meted out by justices and judges. During the same period one year previous, 721 arrests were made and $26,480 was collected in fines. These figures indicate that the Bureau of Patrol is still one of the most important departments of the Division, and that the work along this line will be a never ending task.

Deputies L. T. Ward and Charles Sibeck apprehended two hunters with deer meat in their possession during the closed season. A $1,000 fine was levied in this case, which is an enviable mark at which many of the deputies may aim.

Seven deputies of the Patrol Department who were in their probationary periods of service were separated from the force during the month of January because their work was unsatisfactory.

The patrol boats *Quinnat* and *Hunter* were enlisted in the search for the body of Perry E. Bobo, who was drowned in the Petaluma River in the vicinity of the Black Pond drawbridge. Bobo was the night custodian of the railroad drawbridge.

Bureau of Commercial Fisheries

On November 8 the bids on the new patrol boat were opened in Sacramento. Nine companies bid on the boat and the bids ranged from $57,801 to a little over $79,000. The lowest bidder was the San Diego Marine Construction Company, and they received the contract. Mr. L. E. Geary, the architect, calls it a "service boat," and it will be about the following dimensions: Length, 86 feet; beam, 18½ feet; draft, 7 feet 3 inches. The specifications call for a single drum winch to be used in research work. It was estimated this winch would cost about $1,250. It has since been found that a double drum winch will be needed, and in order that such a winch may be installed, permission has been obtained from the Department of Finance to increase the amount which can be expended on the new boat (including the architect's fee) to $63,000.

The lampara fishermen believe that the sardine supply at Monterey is being depleted by the present fishing operations and they blame principally the purse seine. They are opposed to the operation of additional oil plants on the ground that the sardine supply can not stand the strain. They say that they will be thrown out of employment if the sardine supply fails and their families, who work in the canneries, will be without work.

The sardine season opened in southern California on the first of November and during the month large quantities of sardines were caught. These fish practically all came from the islands 80 to 100 miles distant. During all of the month they ran quite small, and during the first of the month these fish came in in poor condition, making it difficult for the canners to get their 13.5 cases to the ton, as required by law.

Monterey canners all made their 13.5 cases per ton of sardines during the month of December. Very few, if any, of them packed a higher percentage of the sardines than the law requires.

An investigation by the State Fisheries Laboratory as to the reason why some boat loads of sardines are in excellent shape while others are in very poor condition when they are delivered to the canneries was made during the month of January. It was determined that the poor condition of the sardines is caused by keeping them in the boats too long before delivery to the canneries and that there is no evidence that the fish at one point is in poorer condition when caught than fish in another locality.

Bureau of Finance

In the early part of December, the 1930 series of hunting and fishing licenses was received from the State Printing Office and was checked and verified by a representative of the State Controller's Office. The value of the hunting licenses received was $769,000 and of the angling licenses, $691,000. Other licenses received during

the month for issuance in 1930 were game breeder's in amount $1,250; kelp, $50; domesticated fish breeders, $500; domesticated fish importers, $125; and a supplemental order of market fishermen's licenses in the amount of $20,000. The face value of all licenses received was $1,481,925.

The sales for market fishermen's licenses to January 31, 1930, amounted to $36,490. This is an increase of $4,950 over the 1928–29 series at this time last year. The total amount of fish packer's tax receipts as of January 31st was $89,659.60. This is for the period July 1st to January 31st. For the same period last year, $76,463.75 was received.

Bureau of Fish Culture

The collection of Quinnat salmon eggs at the Klamathon station was very disappointing, due to the clear, dry weather in November and early fall. For good runs of salmon in the river, rains are necessary. The poor runs have not been confined to the Klamath River, as the same conditions prevailed at the three government salmon stations on the Sacramento River. While the take at the Klamathon station was small, it was as large as at any of the other stations. The total take for the season was 3,103,000 Quinnat salmon eggs, all of which were shipped by truck to the Fall Creek Hatchery.

While the run of Quinnat salmon on the Klamath was small, the run of trout was the largest in many years. From 150 to 300 large trout were caught in the traps for salmon daily for over six weeks, and liberated in the river above the racks. Besides these, there was a very large run of smaller trout that went through the racks, of which no count could be kept.

During the month of November, the 4395 Atlantic salmon which were being held in tanks at the Prairie Creek station were planted in Redwood Creek. They had reached a length of from four to five inches. During the cold weather of the fall, with consequent lowered water temperature, they added but little to their size, not feeding very heavily in the cold water.

On November 12, 24,000 of the Atlantic salmon raised in the Cold Creek tanks were planted in the South Fork of the Smith River about 40 miles from the mouth. The first plant of 25 cans was distributed in Hurdy Gurdy Creek. Forty-five cans were distributed in the main South Fork of the Smith River after a long, hard trip from Eureka by truck.

A reconnaissance survey was made during November of the principal streams of San Mateo County, followed by a report of the project. The object of this work is a biological survey of these streams. George A. Coleman made the survey.

On December 13, 1929, 898,000 Quinnat salmon were liberated from the Mt. Shasta ponds into tributaries of the Sacramento River. The fish were in fine condition.

On December 30, 1929, 25,000 brown trout eggs were shipped to Samoa. This shipment was made in accordance with the request of Mr. C. W. Dunlap, Chief Pay Clerk, United States Naval Station, Tutuila, Samoa, for a quantity of fertile trout eggs, sufficient to stock a stream leading from the upper reservoir of the naval station.

On December 9, 1929, the remaining 6000 Atlantic salmon in the Cold Creek hatchery were planted in Cold Creek and the Russian River. They had grown quite large and were in fine condition.

The egg-taking station on Shovel Creek has been opened again this season, and is still in the experimental stage. This was the first egg-collecting station operated on the Klamath River, having been established in 1889. It was abandoned in 1911. Being located above the Copco Dam, any eggs collected will be from native river trout and not from sea run fish. Just how many trout enter the creek to spawn is unknown. A station for taking native trout is very desirable.

Bureau of Education and Research

Many additional features have been added to the library of motion picture films. The entire film library has been reorganized, all negative and positive film has been properly labeled and a complete list of films available for loan has been prepared.

Beginning December 10, 1929, the Bureau of Public Relations was discontinued and the work of that department was placed under the supervision of the Bureau of Education and Research.

The publicity work was originally a part of this bureau.

E. L. Sumner, Jr., a graduate of Pomona College, who is now working for a doctor's degree at the University of California, has been appointed a Research Fellow to investigate the relations between predatory species and game. It is hoped that an impartial investigation will bring together much useful information on this subject of controversy.

Gordon True, also a graduate student of the University of California, has been temporarily employed to study the relation of deer to growing crops. There has been much complaint of damage by deer. Mr. True will also investigate disease in deer and its relation to domestic stock.

Bureau of Game Refuges

A final check upon the deer killed for the season of 1929 showed the total to be 21,222, only 280 short of the kill for last year. A check against the returns of previous years shows the proportion of well antlered bucks has remained constant during the three years that the deer tag system has been in effect. Statistics also show that there is an average of nearly one four-point buck to every four deer killed throughout the state.

During the year 1929, 314 bounty claims were filed for mountain lions killed in the state. Jay C. Bruce took five lions alive, for which no bounty claim was filed. Of all the lion hunters in the state, Bruce was high, with a total of 22 animals killed and five taken alive.

During the year 1929, 321 game breeder's licenses were issued; 180 in southern California and 141 in the northern part of the state.

Bureau of Hydraulics

The Mendota wier on the San Joaquin River, operated by the San Joaquin and Kings River Canal and Irrigation Company, has been repaired and now functions in a satisfactory manner. The company has also cooperated in the construction of the fish ladder at this wier.

Bureau of Game Farms

During November, 1929, 30 wild turkeys were shipped from Yountville to be liberated in the Breckenridge Forest Reserve near Bakersfield. The birds were trucked to Crockett, where they were placed on a Southern Pacific train for Bakersfield. Here they were picked up by truck and taken to the point of liberation.

On December 8, 1929, the new Los Serranos Game Farm was officially dedicated. The dedication ceremony was attended by 7947 visitors. This was one of the conservation events of the year, with the Division of Fish and Game, the Associated Sportsmen, the Izaak Walton League of America and other public spirited organizations starring in the activities of the day.

Volunteer Deputies

During the month of December, 1929, the volunteer deputies of the San Francisco district purchased a boat suitable for their work in bay control, and they have equipped the same with motor and trailer at the cost of about $1,000. The boat, motor and trailer have been turned over to the Patrol Department of the division and will be used by the volunteer deputies of the San Francisco district for the enforcement of game laws in general in all districts and the fish laws in the noncommercial fish districts in the bay region particularly.

Between July 1 and December 31, 1929, volunteer deputies, in addition to patrolling many thousands of miles of game fields, streams, coast lines and bay shores, checked 12,664 hunting licenses, 14,961 angling licenses and 9858 deer tags. They made and assisted in making 392 arrests for violations of the game laws, in which cases fines in the sum of $10,975 were imposed.

LIFE HISTORY NOTES

THE MIGRATION OF THE WESTERN MOURNING DOVE (ZENAIDURA MACROURA MARGINELLA) IN CALIFORNIA

The western mourning dove is widely distributed throughout California in spring, summer and fall, but in winter is found only in the southern end of the state and sparingly in the central valleys. (Grinnell, Pacific Coast Avifauna, No. 11, 1915, p. 62.) This seasonal distribution necessitates migratory movements in spring and fall, but the question is, how extensive are the movements? Do the birds shift to the nearest suitable winter areas in the fall and then back to the closest summer range in the spring, or do they make long migratory flights?

The returns from banded mourning doves east of the Rocky Mountains indicate that they make long flights in spring and fall. Two publications of the Bureau of Biological Survey (Dept. Bull. No. 1268, U. S. Dept. Agric., Oct. 16, 1924, and Tech. Bull. No. 32, U. S. Dept. Agric., Dec., 1927) give the record of 130 returns of mourning doves banded during the years 1920 to 1926. All but one of these birds were banded east of the Rocky Mountains. Ninety-nine of these birds were taken at or near the place of banding and give no information as to where they were between the time they were banded and when they were shot or recaptured. But the remaining thirty-one birds made long migratory flights; as for instance, birds banded at Kansas, Illinois, were taken in Alabama, Arkansas, Florida, Georgia, Louisiana and Texas. Georgia seems to be a favorite winter resort for birds from a wide area to the north, as birds banded in Illinois, Indiana, Ohio, New Jersey and New York have been taken in Georgia.

The records of the Western Bird Banding Association for the years 1924 to 1928, inclusive, show only seventy-three mourning doves banded in California during those five years. Almost one-half of these were nestlings, which in some measure accounts for the scarcity of returns. Only two returns from these birds are known to me: No. 338912, banded as a nestling near Artesia, Los Angeles County, May 23, 1926, by James A. Calder, was killed at Downey, Los Angeles County, September 1, 1927, by T. F. Slusser. The distance is about five miles. No. 365512, banded as an adult at 361 S. Thirty-fifth street, San Diego, by E. H. Glidden on February 10, 1928, was killed two miles east of National City, September 1, 1928, by Julia Weisser. The distance is about five miles.

A third return has recently come to my attention that shows that our California birds, in common with their eastern kindred, sometimes make long flights: No. 365539, banded as an adult at San Diego, January 3, 1929, by E. H. Glidden, was killed at Boise, Idaho, October 2, 1929, by John Crowe.

Obviously we need more bands on mourning doves in California. The trapping and banding of adult mourning doves in large numbers, would be sure to bring many interesting returns, and the information thus gained would be of real value to the administrators of the laws designed to conserve this valuable game bird. Such banding must be done of course under permit from the Bureau of Biological Survey and the Division of Fish and Game. I would be glad to correspond with anyone who would be interested in banding mourning doves in California, or anywhere in the west. Here is an opportunity for some one to do some constructive conservation work.—John McB. Robertson, Buena Park, California, January 29, 1930.

COLORADO RIVER TROUT CAPTURED IN IMPERIAL COUNTY

That the Colorado River trout (*Salmo pleuriticus*) occasionally appears in Imperial County is evidenced by the taking of fish of this species on January 21, 1930, in an irrigation ditch connected with the Colorado River by F. E. Cressey. Mr. Cressey reports having planted it alive in a pond.—H. C. Bryant, 510 Russ Building, San Francisco.

OPOSSUM TAKEN AT SAN DIEGO

The capture on January 2 of a Virginia opossum in the henhouse at Allen's Dairy, in Mission Valley, is worthy of note. This animal was taken not far from the place where an opossum was killed on October 24, 1926, but there have been no records of opossums in the meantime. In fact, this latest specimen is only the fourth occurrence in San Diego County known to the staff of the Natural History Museum—the other three having all been secured in widely separated parts of the county during the last three months of the year 1926. It is supposed that the animals, which are liable to become a pest, have been artificially introduced,

but definite information is lacking.—*The Natural History Museum Bulletin*, San Diego, California, February 1, 1930.

BREEDING HABITS OF MULE DEER

On November 6, 1926, in an open flat on the Yankee Jim Allotment, Warner Mountains, Modoc County, California, I saw a band of deer acting as though something was bothering them. I left my horse, sneaked up to a point about 200 yards from the deer and climbed a small juniper the better to observe what was going on. I soon perceived that the animals were rutting. There were 17 deer in the band—14 does and 3 bucks. One was a large seven-pointer, the second, a three-pointer and the third buck a forked-horn. The large buck was continually trying to drive the smaller bucks away from the does. I watched them for about an hour and a half. The large buck would chase the three-pointer about 100 yards from the does, then look back and see the forked-horn with the does. He would then chase off the forked-horn while the three-pointer would follow back to the does. During the time that I watched them, the small bucks made nine covers and the large buck not one. The large buck's exertions were telling on him and he was nearly run down.

On June 17, 1927, I again crossed the Yankee Jim Allotment. I saw 7 does with 11 fawns which all looked to be about the same age. There are always many deer on this range.

On November 3, 1928, I saw nine does and a forked-horn buck on Bear Flat. I watched them for about two hours and during that time the buck made six covers.

In Long Valley, the early part of November, 1927, I saw a band of does feeding. A large buck came out of the timber, separated one doe from the band and drove her off down the valley into the timber. I have noticed this occur many times. The old bucks will single out one or two does and herd them away from the other deer. The young bucks, on the other hand, will run with a band of does. Many of the old residents of Surprise Valley have observed these same habits and will vouch for this statement.

From my observations I am of the opinion that the breeding season for the mule deer in the Warner Mountain section is from about October 20 to December 20. The heaviest breeding season is during the first twenty days of November. The gestation period for mule deer is 212 days. From records I have kept during the past six years, 75 per cent of the small fawns I have noticed were born between June 5 and July 1. During this period in 1929, I saw 129 small fawns that looked to be from five to twenty days old. In the same period in 1928, I saw 142 fawns. The earliest fawn I have any record of seeing was born May 17, 1926, and the latest fawn I ever saw was born on August 7, 1929.

On the evening of August 6, I noticed that an old doe, which had been staying in the horse pasture at Patterson Ranger Station for the past five seasons, was heavy with fawn. The next morning when I went after my horses this doe got up out of some brush and trotted off. The dog went over toward where she had been lying and the doe came back after him. I went over to see why she was chasing him about and there were two fawns. They had just been born and were still wet. I watched these fawns to see how long it was before they started following their mother. On the sixth morning when I went after my horse I found that they were following her. I noticed them nearly every day I was at Patterson Ranger Station until about October 1.

This old doe has raised ten fawns in the six summers. In 1924, she appeared on June 12 with two fawns; on June 10, 1925, she had one fawn with her. In 1926, on July 11, I saw her with two fawns and on June 14, 1927, she had one fawn. On June 6, 1928, she had two fawns and on August 7, 1929, two fawns.

A good many of the small bucks run with the does the entire season. Several times I have seen a band of does in July and August with two forked-horns and a three-point buck with them.

On August 15, 1929, I saw thirty-three deer in one band at the head of Shilds Creek. There were 12 does, 18 fawns, 1 three-point buck and 2 forked-horn bucks in the band. The next day, I also saw a forked-horn buck with eight does and fawns. I can not recall seeing a large buck with does before October 10 and then only occasionally. From all appearances the large bucks do not begin to come out to the does until about October 20.

For the past five seasons I have kept a list of the deer I have seen: 1925, 861; 1926, 1232; 1927, 1321; 1928, 1420; 1929, 1426. I did not attempt to keep a separate record of the bucks.

I am of the opinion that the buck under five years of age is the best breeder. We all know that the two- or three-year-old bull is better than the older bull on the range. All the successful sheepmen do not believe in keeping a ram over four years old.—Oscar L. Barnum, U. S. Forest Ranger, Cedarville, California, January 7, 1930.

COMMERCIAL FISHERY NOTES

N. B. Scofield, Editor

HOW ABALONES ARE SOMETIMES PLANTED

The bulk of the fresh abalone that is eaten by Californians comes from Monterey. During the past few years over 2,000,000 pounds of this delicious mollusk meat have annually left the Monterey markets. To help supply this demand, eight abalone boats deliver to four of the markets at Monterey that are equipped to handle abalone. During the abalone season, which lasts from March 16 to January 15, one of these boats will bring in from 60 to 250 dozen market-size abalones each trip. As high as 1600 dozen have been unloaded by these eight boats in a day.

Early on the morning of November 5, 1929, the Japanese abalone boat *Nagato*, carrying a crew of five men (including two divers), was coming in to deliver its capacity load of 250 dozen abalones to the A. Paladini Company. It had successfully made the run up the coast from below Point Lobos, and was well within Monterey Bay when the boat ran into a heavy fog. The fog confused the pilot of the *Nagato*, who failed to allow enough clearance for China (Mussel) Point, on which the Hopkins Marine Station of Stanford University is located. The boat hit the rocks of the point and turned over on its side, throwing men, equipment and abalones into the water. Luckily, another abalone boat had been running alongside farther out, and so the *Nagato* crew swam to the other boat. As the law specifies that abalones must be brought to shore in the shell and in a live condition, and as the wreck occurred in a district closed to diving, the result was a plant of 250 market-size abalones on the rocks of China Point.

The Division of Fish and Game of California has found that specifying an eight-inch lower limit on the size of the abalones taken by the market fishermen will not deplete the supply to any extent, for at this time the abalone has spawned several times and is past the peak of productive spawning, so that the weeding out at this size may be really beneficial on the whole.

The abalones landed at the Monterey markets are obtained entirely by diving in District 18 (which extends from the mouth of the Carmel River to the southern boundary of Santa Barbara County). The diving must be done in twenty or more feet of water, as the law specifies that no abalones may be sold that are taken between high water mark and twenty feet below extreme low tide in Districts 7, 10 and 18. This insures a permanent supply for the sportsman, whose activities are naturally confined to wading at low tide.—J. B. Phillips, California State Fisheries Laboratory, November 30, 1929.

SHOULD THE SWORDFISH BE PROTECTED

For many years anglers at Santa Catalina Island considered the leaping tuna the finest of the game fish. In more recent years, attention has been diverted to the swordfishes. Meanwhile, a market has developed for swordfish and a number of fishing boats are equipped for the taking of these great predatory fish. Anglers now claim the supply has diminished. Zane Grey, famous author, maintains that anglers are leaving Santa Catalina waters and are finding better sport in other places. He also maintains that the broadbilled swordfish should be protected by law and its sale prohibited. This stand is taken not to furnish a few millionaire sportsmen with some game fish to catch, but on the basis of saving a valuable asset of California which furnishes a great advertising medium. The big fish of southern California are classed along with such other glories of the Golden State as redwood trees, high Sierra, sunshine and good roads.

One of the points to be considered in giving the swordfish protection is that this fish has never been abundant and that intensive fishing for it might make depletion more rapid than when an abundant fish is considered.

ABALONES IN DEMAND

Statistics which have just been compiled by the Commercial Fisheries Bureau show that during the past several years over 2,000,000 pounds of abalone meat have been taken off the coast of Monterey.

To help supply demand, eight abalone boats deliver to four of the markets at Monterey that are equipped to handle abalone. During the abalone season, which lasts from March 16 to January 15, one of these boats will bring in from 60 to 250 dozen market-size abalones each trip. As high as 1600 dozen abalones, all alive and in their shells, have been deliv-

ered by the eight operating boats in a single day.

Experience has shown that specifying an eight-inch minimum size limit on abalones taken by market fishermen does not deplete the supply to any extent, for by the time the abalone has reached that size it has spawned several times, and is past the peak of productive spawning. Weeding out at that size may actually be beneficial to the species. Here is an instance where suitable protection has brought about conditions which allow of a large annual harvest of a delicious shellfish without endangering the supply.

TRANSPORTING TOTUAVA BY TRAINS

The totuava or Mexican white sea bass is now being transported in refrigerated railway cars from Guaymas to San Pedro, a distance of about 800 miles. This is a departure from the old method of hauling the fish over the long journey by truck. The trucks which are used to haul the fish shorter distances are now also being equipped with ice. This fish is caught in the Gulf of Lower California and was originally sought mainly by native Indians for their sounds, which were dried and sold to Chinese markets.

NEW COMMERCIAL FISHERIES PATROL BOAT

Late in December the contract to build the new, up-to-date patrol boat for the Bureau of Commercial Fisheries, Division of Fish and Game, was let to the San Diego Marine Construction Company of San Diego. The boat was designed by L. E. Geary, well-known naval architect, from rough plans by Capt. H. B. Nidever, and is a substantial service boat, well suited to the business of enforcing the state fisheries laws and to carrying on scientific research. Work was begun on this boat immediately and she will be ready for service early in May. She is 86 feet long, with a beam of 18½ feet, and will be powered with a 200 h.p. Atlas-Imperial engine of the direct reversible Diesel type. The budget allowance for building the boat was $60,000 and the bid of the San Diego company was the lowest received, it being $58,800.

In carrying on research work on both sardines and tuna, it will occasionally be necessary for this boat to travel a long way from a fuel supply, and she is therefore equipped with fuel tanks which give her a cruising radius of 6000 miles. There are accommodations on the boat for twelve persons, although she can be handled for ordinary cruising by four persons. The extra accommodations are for additional deputies for special patrol work and for occasional trips of scientific workers. A small laboratory is provided and a special feature is a double-drum winch, operated by a 7 h.p. electric motor, for hydrobiological work in connection with the sardine and other fisheries research. Each drum of this winch carries 1000 fathoms of 5/16" steel wire cable which will enable the boat to be anchored in very deep water by the cable of one of the drums, while a meter for determining the currents, and nets, water-bottles, thermometers, etc., can be operated at all depths at the same time by the cable on the other drum.

When the boat is put in commission in southern California, the *Albacore*, which has now been in service twelve years, will be moved to northern waters, with her base at Monterey. She is to be equipped with a similar double-drum winch for continuing the cooperative arrangement between the Division of Fish and Game and the Hopkins Marine Station in carrying out a hydrobiological survey of the Monterey Bay region.—N. B. S.

METHODS OF CONSERVING FISHING RESOURCES

The following brief article by Lewis Radcliffe, Deputy Commissioner, United States Bureau of Fisheries, splendidly sums up the means to be taken to properly care for and administer the fishery resources of state and nation:

The abundance of fish attracted the early explorers to our country; in fact a cod fishery existed prior to the establishment of the first permanent English colony in this country.

When the Pilgrims applied for a charter for the *Mayflower* from King James of England, they asked "leave to worship God according to their own conscience, and to catch fish." Without an abundant supply of sea foods, some of the early settlements would have been destroyed from starvation.

At one period the fisheries were "the cornerstone of New England's prosperity." They are still the most important resource of Alaska.

Despite the richness of our land in aquatic resources, within a century after the signing of the Declaration of Independence—on February 9, 1871, to be exact—a joint resolution of congress was approved appointing a commissioner of fish and fisheries to conduct investigations to determine the facts and the causes of the alleged diminution of the fish supply and the feasibility of remedial measures.

From this humble beginning there has developed the Bureau of Fisheries of to-

day, devoting itself to the manifold fisheries problems—husbandry, propagation, fisheries technology, marketing and the administration of the fisheries of Alaska and the fur-seal herd of the Pribilof Islands.

The history of our fisheries during the last half century resolves itself into three phases. During the first phase the fisheries for certain staples such as shad, sturgeon, whitefish, lake herring, lobsters and oysters, reached their maximum production succeeded by a downward trend which clearly indicated depletion. The maximum production of six such staples exceeded 370,000,000 pounds as compared with a present level of less than 160,000,000 pounds.

During the second phase an enlarged market, created by a rapidly growing population and other factors, made additions to the stock of staples necessary. This was accomplished by replacement with hitherto unused or neglected species on a huge scale.

During this period we have witnessed the catch of pilchards in California increase from 1,000,000 to 420,000,000 pounds; the growth of the herring industry of Alaska to nearly 80,000,000 pounds; the growth of the fishery for shrimp in the South Atlantic and Gulf states to 70,000,000 pounds; the crab catch of Chesapeake Bay to 50,000,000 pounds; the haddock fishery of New England to over 200,000,000 pounds; and the pike perch fishery of the Great Lakes to 27,000,000 pounds.

With the end of the second phase, when large replacements are no longer possible, we are entering the third phase, which is characterized by an era of more careful husbandry of the existing supply and the development of aquiculture as a means for supplementing the natural stock.

A knowledge of these phases is essential to an understanding of the fisheries situation as it now exists. The care and upbuilding of our fisheries involves four main phases:

1. Husbandry of the existing fishery resources.

2. Development of aquiculture or water farming.

3. Technical research to assure the best use of our fishery products and uses for the neglected products of the sea.

4. Fishery administration.

PISMO CLAM CENSUS

Low tides, accompanying the full lunar stages of the middle of November, afforded opportunity for the annual clam-count of Pismo Beach. W. L. Scofield, director, and several staff members of the California State Fisheries Laboratory, gathered at Pismo on Friday, November 15, 1929, and brought out rusty clam forks, hard old wading shoes, measuring ropes and old work clothes in preparation for the chilly job ahead. The plan was to "make the sections" during the extreme low tide of Sunday.

This business of "sampling the beach" is an annual happening. The thing had its commencement some years ago, and has been carried on ever since. The way the trick is done is to rope off a narrow strip of sand, from high up where no clams of any size are found, to as far out as the receding waters of the low tide will allow. The sand between the two parallel ropes is dug up and run through a sieve to catch all of the clams, no matter how small they are. These clams are counted, and classified as to age, and on this basis the condition and clam crop of the whole beach is determined. It has been found that either because of surf action or other causes the population of the beach is kept quite uniform in disbursement. Of course, the "sections" that are dug up each year are always laid out at the same places along the Pismo-ocean shore. The results have been very successful.—*West Coast Fisheries*, January, 1930.

PROPORTIONS OF KING AND QUEEN FISH IN THE SAN PEDRO WHOLESALE FISH MARKETS

In the catch records gathered by the Bureau of Commercial Fisheries, the numbers of pounds of king fish, *Genyonemus lineatus*, and of queen fish, *Seriphus politus*, are recorded under the name king fish. To determine how greatly these records were in error for the San Pedro catch, an analysis was made of the proportions of these fish delivered to the San Pedro fish markets.

The study was carried on from December, 1928, through December, 1929. In order to correlate all scientific studies with the fishing industry, these markets are visited semiweekly by the writer. In the course of these visits, the proportions of king and queen fish were estimated on each visit. The percentages thus secured were weighted by the amount of fish observed, and the monthly and yearly percentages for each species calculated. The average for the thirteen months involved in the study was 98.93 per cent king fish and 1.07 per cent queen fish. These proportions were relatively constant from month to month, the highest percentage, 5.25, of queen fish occurring in the month of February.

Although these percentages represent data based on rather rough approximations, it is evident that almost the entire catch off San Pedro of these two species of fish is composed of king fish. Since queen fish occur but rarely north of Point Concepcion while king fish are taken off Monterey and San Francisco, the records for the northern localities involve king fish only. Very few king fish are reported from San Diego and the error involved in classifying king and queen fish under the name king fish is practically negligible for the southern California catch and also for the entire state.—Frances N. Clark, California State Fisheries Laboratory, Terminal Island, January, 1930.

A RECENT PUBLICATION ON WHITE SEA BASS. FISH BULLETIN No. 21

A report by S. S. Whitehead of the California State Fisheries Laboratory, on an "Analysis of Boat Catches of White Sea Bass (*Cynoscion nobilis*) at San Pedro, California," has recently been published.

This investigation was carried on in order to determine the present condition of the white sea bass fishery. The procedure used was a calculation of the return per unit of effort for each year of the period 1918 to 1928. In order to fully understand the fishery, a study of the gear and fishing methods was also made. The yearly total catch and average yearly boat catch (total catch divided by total number of boats engaged in the industry) were discussed as a criterion of the fishery. As the inaccuracies of total catch and average boat catch per year were too numerous, a finer method of computation was found necessary. Both average boat catch per month and average boat catch per trip were tried, and the former was chosen as the more accurate method so it was used as the index of the condition of the fishery. Various methods of computing the average monthly boat catch and average boat catch per trip were calculated and presented in graphic form.

Both the month and trip catches by their downward trends indicate marked depletion of the fishery, and show the need of protection to insure against commercial extinction.

Copies of this publication may be obtained by writing to the California State Fisheries Laboratory, Terminal Island.

HERRING IN CARQUINEZ STRAITS

The Pacific herring, *Clupea pallasii*, is found in considerable numbers in California in Tomales, San Francisco, Monterey, and San Diego bays. At rare intervals immense runs of herring are reported. One such migration occurred in Carquinez Straits near the head of San Francisco Bay early in February, 1930. Fortunately, a trained field observer, William Everson of Selby, was on hand to record the facts. According to him, nothing unusual was to be seen on Saturday, February 8th, but the next day incredible numbers of herring were to be seen all along the Contra Costa County shore from Rodeo up to Port Costa, a distance of seven or eight miles. The heavy run lasted three days, after which the numbers of fish became fewer, although many fish were to be seen for three more days. The fish were without fear and could be approached with ease, although they would not take bait of any sort. They were in such large numbers that people using snag hooks, improvised nets and pieces of old wire netting, had no trouble in procuring sacks and buckets of them. One man caught 150 pounds in an hour with an ordinary trout landing net. Mr. Everson filled three buckets with herring by walking along the shore and picking them off of the rocky beach where they had been stranded. The fish were uniformly small, seven to eight inches in length being the usual size. The uniformity of size suggests a successful spawning during a recent season. According to old-timers, the last run comparable at all with the one of this year was thirty-two or thirty-three years ago, and was similar in all respects. Rumors reported large runs at Sausalito and at the mouths of the Russian, Garcia, and other rivers during February.

Spawning was evidently the reason for the fish coming to the shore. Tony Dowrellio of Crockett claims to have found herring spawn on the rocks along the shore in other years, but never in such large amounts. The fish spawned in shallow water up to high tide mark on rocks and piles but not on sandy or mud bottom. The eggs, which are about one millimeter in diameter in the ripe fish, swell to one and one-half millimeters after immersion in the water. The eggs are yellowish, and although not sticky, adhere firmly to the rocks and to each other. Nearly every pile and rock along the shore was covered with half an inch of eggs by the time the run ended. In places the depth of the egg deposit exceeded two inches. Mr. Everson visited the rocks late in February, and the eggs at the outer edge of the layer seemed to have hatched, but the inner ones appeared to be dead, undoubtedly suffocated.—Richard S. Croker, California State Fisheries Laboratory, Terminal Island, February, 1930.

CANNING OF MACKEREL DURING SARDINE SEASON AT SAN PEDRO

It is well known that almost all the sardines landed in California are caught on dark nights. Moonlight is too bright to permit locating schools of fish by the phosphorescence in the water. During the full moon period there are about three days when the moon shines from dusk till dawn. Besides this there are several more days when the dark part of the night is exceedingly short. As a result there is a period, sometimes as long as ten days, when no sardines are caught. Prior to the 1928–29 season the canneries lay idle during these periods. However, beginning in October, 1928, they started using mackerel as a fill-in-product during full moons. From February on till the end of the season, the fishermen are usually able to catch sardines in daylight, thus insuring a continuous supply. As a result mackerel were not in great demand during the latter part of the 1928–29 season. The current season (1929–30) is not over yet, but the demand for mackerel has fallen off greatly (February 27, 1930).

Mackerel, unlike sardines, are caught in daylight and consequently are ideal to fill in during full moon. At first many boats used their sardine nets to catch mackerel. Since then most of the boats which decided seriously to fish mackerel have built special nets for this purpose. The mackerel are caught principally by the smaller sardine boats and by boats too small to profitably fish sardines.

During the summer months canneries use large quantities of mackerel when tuna are not being brought in, or even at the same time if the supply of tuna is not large.

The mackerel catch at San Pedro was 30,000,000 pounds during 1928, and 44,000,000 in 1929.—D. H. Fry, Jr., California State Fisheries Laboratory, Terminal Island, February, 1930.

MEXICAN FISH IN SAN PEDRO MARKETS

The San Pedro fish markets, always interesting, are particularly attractive during the winter months when the large boats which fish in Lower California unload their catches of exotic species of fish. This year more than ever before there has been an increasingly large supply of species new to our markets, the old standard importations—barracuda, yellowtail, halibut—losing prominence to the grouper, cabrilla, shrimps, totuava. Comparatively large quantities of smaller fish, such as the tai, mojarras, robalo, palometa, Mexican pompano, Mexican corbina, Gulf corbina, scaly finned corbina, have augmented our local supply of miscellaneous species. While these smaller fish are still of slight importance commercially, who can say how soon the demand for local species (as distinguished from cannery species) will exceed the available supply, necessitating a more extensive exploitation in waters farther south?

The Mexican fish which have been identified during January and February, 1930, by members of the staff of the California State Fisheries Laboratory, Terminal Island, are as follows:

Acanthocybium solandri (Wahoo)
Anisotremus cæsius (Mexican sargo)
Brachydeuterus leuciscus (Burrito)
Calamus brachysomus (Mexican tai)
Centropomus viridis (Robalo)
Cynoscion macdonaldi (Totuava)
Cynoscion othonopterus (Gulf corbina)
Cynoscion parvipinnis (Small-finned corbina)
Cynoscion xanthulus (Scaly-finned corbina)
Epinephelus analogus (Mexican cabrilla)
Gnathanodon speciosus (Mojarra dorada)
Kyphosus analogus (Salema)
Micropogon ectenes (Verrugato)
Mugil curema (White mullet)
Mycteroperca sp. (Grouper)
Neomænis aratus (Striped snapper)
Neomænis argentiventris (Silver snapper)
Neomænis novemfasciatus (Black snapper)
Pomadasis macracanthus (Burro)
Scomberomorus sierra (Spanish mackerel)
Trachinotus kennedyi (Palometa)
Trachinotus paloma (Pompano)
Umbrina xanti (Roncador)
Xystæma cinereum (White mojarra)

—L. A. Walford, California State Fisheries Laboratory, Terminal, February, 1930.

LARGE PISMO CLAMS

Two unusually large Pismo clams, *Tivela stultorum*, have recently been sent to the California State Fisheries Laboratory, Terminal Island. These clams were taken by W. G. Williams on Grover Bar, Pismo Beach. The first specimen, found on December 23, 1929, measured 172 mm. (6.9 inches) in greatest diameter, and by means of the number of dark rings in the shell, was estimated to be 27 years old. If this age is correct, this constitutes the oldest Pismo clam on record. The second individual, also secured from Grover Bar on February 15, 1930, measured 183 mm. (7.3 inches) in diameter. No clam equaling this size has been re-

corded previously in the Pismo clam studies of the Division of Fish and Game. While the largest clam on record, this latter specimen did not equal in age the former, being apparently only 23 years old.—Frances N. Clark, California State Fisheries Laboratory, February 21, 1930.

RELATION BETWEEN COD AND HERRING CATCHES IN THE DANISH WATERS OF THE BALTIC SEA

In European waters the cod has long been considered one of the worst enemies of the herring. Several investigations have shown that cod feed upon herring to a considerable extent. In a recently published paper, Aage J. C. Jensen [1] indicates an association between the herring catch and the cod catch from the Danish waters of the Baltic Sea.

By means of detailed tables the author of this paper demonstrates that the fluctuations in the yield of both the cod and herring fisheries of these Danish waters have not been dependent on changes in the amount of fishing gear or on changes in fishing intensity resulting from price fluctuations during the period 1909–1927. The total catch of the Danish cod and herring is, therefore, indicative of the size of the stock, and the total catch records are usable to demonstrate the relation between the cod and herring catches.

Herring are taken by nets and pound-nets, drift-nets, and purse seines. The purse seines take, as a rule, a larger quantity of small and young herring than do the other types of gear. The net and pound-net catches are composed of somewhat older and larger fish, and the drift-nets take the largest herring. A good yield from the net and pound-net fishery was followed by a good yield in the drift-net fishery in the same and the following year, which is explained by the fact that the drift-nets tend to take older fish than do the net and pound-nets.

By means of careful mathematical analyses, a negative correlation was shown to exist between the total cod catch and the total net and pound-net herring catch one and two years later. A similar negative correlation existed between the cod catches and the drift-net herring catch two and three years later. Thus a large cod catch was followed from one to three years later by a poor herring catch. Presumably the cod feed mainly on small herring one and two years old, while the herring do not become an object of the fishery until their third and fourth years. But Jensen points out that other causes than abundance of cod can affect the herring fishery. In good spawning years so many herring may be produced that even a large cod stock is unable to prevent a good take of herring in later years. Conversely, a small cod stock will not invariably be followed by a large herring catch, for poor spawning years may keep down the size of the herring stock.

One explanation for the fluctuations in the cod yield is suggested in the high relationship between the total cod catch and water temperatures on the bottom four years previous. High water temperatures were followed by large cod catches four years later. The largest number of cod fry are found on the lowest water layers, and possibly the higher water temperatures tend to produce more favorable conditions for the survival of the fry.—Frances N. Clark, California State Fisheries Laboratory, Terminal Island, January, 1930.

[1] On the influence of the size of the stock of cod upon the yield of the herring fishery in the Kattegat, Belt Sea, and western part of the Baltic, and some other causes of variations in the cod and herring fisheries. Meddel. Komm. Havundersøgelser, Serie: Fiskeri, Bd. 8, Nr. 8, pp. 1–16, 1929.

RUSSIA COMMENTS ON CALIFORNIA'S COMMERCIAL FISHERIES

Interesting statements may readily be culled from a French or German scientific publication, but the pages of a journal printed in Russian seldom show a recognizable character. However, it has been possible to discover that in the "Report of the Scientific Institution of Fisheries," Volume 3, Number 4, published in Moscow, there is an article "On the Methods of Catching the White Sea Herring" which contains a reference to fishing methods used in California. The discovery was made easier because of the use of two sets of figures which appeared in an article entitled, "Methods of Sardine Fishing in Southern California," CALIFORNIA FISH AND GAME, Volume 7, Number 4.

There is also to be found a bibliographical citation to our publication at the end of the article. As far as we are aware, this is the first time that this publication has given recognition to California methods of fishing.

SEA LIONS PROTECTED IN ALASKA

Sea lions are given protection in Alaska by the federal government. The killing of these animals is prohibited in the Territory of Alaska or in any of the waters of Alaska over which the United States has jurisdiction. Provision is made that the natives may kill these animals for food or clothing, or they may be killed in the necessary protection of property or

while such animals "are actually engaged in the devastation of runs of salmon."—From "Alaska Fishery and Fur Seal Industries in 1928," U. S. Bureau of Fisheries.

SOME NOTES ON THE FOOD OF SEALS AND SEA LIONS

A questionnaire was recently sent to seal and sea lion hunters by the Chamber of Commerce of Port Orford, Oregon. The men who returned these questionnaires have killed thousands of seals and sea lions, and some of them have had the curiosity to examine the stomach contents. Their unanimous opinion is that the present Oregon bounty should be removed, as the seals and sea lions are not destructive to commercial fish and fishing. They list as the food of sea lions, skate, ling cod, snappers, octopii, squawfish, redfish and crabs.

In a report of the Chief Inspector of Fisheries and Game of Victoria, Australia (1929), is the following regarding a species of fur seal found in Australian waters:

"The complaints of fishermen that the seals are a serious menace to the fishing industry on the Victorian coast have not, in my opinion, been substantiated. That there is some interference can not be denied, but it would appear that on the whole most of the reports have greatly exaggerated the trouble. * * * Investigation has proved conclusively that seals will and do eat fish whenever they get the chance, but it would appear that the majority of the commercially valuable fish, such as whiting, pike, snapper, and so on, are well able to look after themselves."

In the Report of the Sea Fisheries of Wales for 1926, appears a short notice, under the heading of "Fishery Pests." This states that a bounty has been paid for seals (Phoca?), when the stomach has been turned in with the scalp. The report states that "the results have been inconclusive inasmuch as all the animals had been feeding on some species of pelecepod." This statement opens the way for some mild sarcasm. If the stomachs had contained commercially valuable fish, the result would no doubt have been conclusive enough.

All the investigations, which have been made by competent men, regarding the food habits of the seals and sea lions have resulted in showing that these animals are not detrimental to commercial fishing. Yet ever so often, a furor is raised and a demand made that the seals and sea lions be killed, as they are consuming vast quantities of valuable fish.

A point which has been generally overlooked is that during the last century the number of seals, fur seals and sea lions killed for their hides and oil ran into the millions, completely exterminating several species and reducing others to the point of extermination.

If, after these millions of animals have been removed, certain species of fishes become less numerous, the logical conclusion (to a biologist, at least), is to attribute the condition to the animal known to take these fishes in vast quantities, and that animal at present is Man.—Paul Bonnot, 510 Russ Building, San Francisco.

A CORRECTION

In the article, "Comparison of English and United States Fishing Ports, 1926–1927," by Genevieve Corwin, appearing in California Fish and Game, Volume 15, Number 4, Portland, Maine, should not have been included in the comparison, since the landings of this port are insufficient to figure with the other ports listed.

As was explained in the article, the information for United States fishing ports outside of California was obtained from the Statistical Bulletins of the United States Bureau of Fisheries (Nos. 729 and 773). Unfortunately these bulletins do not carry an explanation that the figures are incomplete and due to the fact they cover landings by vessels of five net tons or over, the figures for Boston and Seattle would be augmented, but exactly how much is not known, since no records are kept for the boats smaller than five net tons.—G. C.

SEIZURES OF FISH AND GAME

October, November, December, 1929

Abalone	1,089	Deer	48
Barracuda, pounds	10,568	Deer meat, pounds	302
Bass, striped	261	Doves	33
Bass, striped, pounds	800	Ducks	759
Catfish, pounds	75	Geese	81
Clams	1,609	Hides	14
Crabs	57	Nets, bird	2
Carp, pounds	50	Mudhens	3
Lobsters, pounds	1,297	Pheasants	18
Lobsters	1,436	Pigeons	2
Nets, seines	5	Nongame birds	161
Salmon, pounds	330	Quail	69
Salmon	81	Rabbits	16
Steelhead, pounds	80	Seagull	1
Steelhead	11	Shorebirds	114
Sunfish	50	Swans	3
Small fish	51	Squirrels, tree	3
Spears (illegal)	6	Traps, steel	4

FISH CASES

October, November, December, 1929

Violation	Number arrests	Fines imposed	Jail sentences (days)
Violations of Angling License Act	22	$510 00	
Abalones; overlimit; small	52	1,050 00	
Barracuda; small	3	250 00	
Commercial Fishing License Act; violations of	24	515 00	
Clams; overlimit; small	43	1,475 00	60
Crabs; closed season; female	2	100 00	
Crappie; closed season	2	25 00	
Lobsters; small; closed season	40	1,440 00	
Nets; set lines; illegal	19	1,360 00	5
Striped bass; small; overlimit	37	1,095 00	25
Spears; fish; illegal	49	940 00	12½
Sunfish; overlimit	2	70 00	
Salmon; overlimit; closed season shooting of	22	435 00	
Small fish	2	40 00	
Trout; closed season	2	50 00	
Totals	321	$9,355 00	102½

GAME CASES

October, November, December, 1929

Violations	Number arrests	Fines imposed	Jail sentences (days)
Violations of Hunting License Act	130	$3,750 00	25
Commercial Gun Club; no license	2	50 00	
Deer; spike buck, does, fawns, killing of; failure to tag; closed season	87	5,090 00	400
Doves; closed season	9	290 00	
Ducks; illegal shooting day; over limit; selling of	15	430 00	
Geese; closed season; over limit	5	125 00	
Nongame birds; killing of	51	1,620 00	
Quail; closed season; trapping of	27	1,330 00	
Rabbits; closed season	7	125 00	
Refuge; firearms in; killing deer in	9	250 00	
Pheasants; killing of	10	800 00	
Pigeons; closed season	1	100 00	
Pollution of streams	2		
Night hunting	37	885 00	
Shore birds; killing of	53	1,195 00	
Swan; killing of	1	50 00	
Shooting from auto; motor boat	8	185 00	
Trespassing on posted grounds	14	340 00	
Trapping License Act; violations of	9	95 00	60
Tree squirrels; killing of	6	175 00	30
Woodducks; killing of	4	50 00	
Totals	487	$16,935 00	515

REPORTS

STATEMENT OF EXPENDITURES

For the Period July 1, 1929 to December 31, 1929 of the Eighty-first Fiscal Year

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Administration:					
Executive and legal	$8,409 96		$24 70		$8,434 66
Clerical and office	8,964 45	$618 38	570 28	$102 85	10,255 96
Printing		2,755 40			2,755 40
Automobiles		150 62	11 40		162 02
Traveling			2,385 52		2,385 52
Postage			1,947 96		1,947 96
Telephone and telegraph			2,211 87		2,211 87
Freight, cartage and express			1,398 08		1,398 08
Rent			8,732 15		8,732 15
Heat, light and power			132 38		132 38
Accident and death claims			2,192 02		2,192 02
Accounting pro rata	3,535 00				3,535 00
Legal			319 45		319 45
Total administration	$20,909 41	$3,524 40	$19,925 81	$102 85	$44,462 47
Education and research:					
Chief and assistant	$3,291 94		$10 00		$3,301 94
Clerical and office	1,092 00	$76 34	114 76	$296 37	1,579 47
Traveling			1,581 23		1,581 23
Photographer	600 00		176 25	593 27	1,369 52
Librarian	960 00	81 48	20 00	45 24	1,106 72
Publicity			2 00		2 00
Exhibits			30 00		30 00
Research	1,825 00	110 86		30 70	1,966 56
State fair	276 00	260 71	800 35		1,337 06
Freight, cartage and express			2 00		2 00
Lecturers	1,620 00				1,620 00
Total education and research	$9,664 94	$529 39	$2,736 59	$965 58	$13,896 50
Publicity:					
Chief of Bureau	$1,650 00		$253 61		$1,903 61
Traveling			39 40		39 40
Total publicity	$1,650 00		$293 01		$1,943 01
Patrol and law enforcement:					
Chief and assistants	$6,630 00				$6,630 00
Clerical and office	1,450 00	$90 56	$12 64		1,553 20
Automobiles		1,471 87	790 62		2,262 49
Traveling			70,614 05		70,614 05
Captains and deputies	105,533 27	231 04	1,091 88	$205 15	107,111 34
Fish planting	1,602 66	388 81	998 00	828 00	3,817 47
Watchmen	30 00				30 00
Launches	1,020 00	518 75	210 36		1,749 11
Volunteer deputies	425 00				425 00
Premiums on bonds			1,255 00		1,255 00
Freight, cartage and express			4 77		4 77
Rent			95 18		95 18
Total patrol and law enforcement	$118,740 93	$2,701 03	$75,072 50	$1,033 15	$195,547 61
Commercial fisheries:					
Chief and assistants	$5,250 00				$5,250 00
Clerical and office	4,469 39	$96 87	$48 59	$21 08	4,635 93
Automobiles		171 47	61 21	506 02	738 70
Traveling			9,158 23		9,158 23
Research	3,302 50				3,302 50
Captains and deputies	7,990 00	62 98	10 62	18 00	8,081 60
Launches	2,490 00	947 28	896 84	4 70	4,338 82
Statistics	1,470 00	299 00			1,769 00
Laboratory	15,589 50	337 72	908 95	158 18	16,994 35
Fish tags:		412 50			412 50
Postage			20 00		20 00
Botulism			7,500 00		7,500 00
Freight, cartage and express			28 07		28 07
Heat, light and power			2 11		2 11
Inspectors	15,512 11				15,512 11
Total commercial fisheries	$56,073 50	$2,327 82	$18,634 62	$707 98	$77,743 92

STATEMENT OF EXPENDITURES—Continued

For the Period July 1, 1929 to December 31, 1929 of the Eighty-first Fiscal Year

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Fish culture:					
Chief and assistants	$3,300 00				$3,300 00
Clerical and office	1,950 00	$31 08	$4 00	$3 05	1,988 13
Automobiles		2,793 87	1,093 08	1,227 50	5,114 45
Traveling			6,966 76		6,966 76
Telephone and telegraph			418 83		418 83
Rent			662 13		662 13
Heat, light and power			451 62		451 62
Hatcheries	67,469 39	33,988 93	1,923 16	2,361 95	105,743 43
Hatcheries—additions and betterments				332 00	332 00
Special field investigations	5,780 00	18 97	218 08		6,017 05
Fish cars		105 59	1,203 84		1,309 43
Blue printing			3 90		3 90
Freight, cartage and express			212 24		212 24
Total fish culture	$78,499 39	$36,938 44	$13,157 64	$3,924 50	$132,519 97
Hydraulics:					
Chief and assistants	$2,970 00		$18 37		$2,988 37
Clerical and office		$14 42	26 50		40 92
Automobiles		225 29	78 55		303 84
Traveling			782 83		782 83
Cooperative research	1,500 00	2 10	36 15		1,538 25
Blue printing			13 23		13 23
Total hydraulics	$4470 00	$241 81	$955 63		$5,667 44
Game propagation:					
Superintendents	$2,060 00				$2,060 00
Automobiles		$219 41	$21 88	$864 51	1,105 80
Traveling			1,472 53		1,472 53
Heat, light and power			228 54		228 54
Laborers	3,695 27				3,695 27
Maintenance		3,882 77	270 31	1,364 83	5,517 91
Telephone and telegraph			27 67		27 67
Total game propagation	$5,755 27	$4,102 18	$2,020 93	$2,229 34	$14,107 72
Fish rescue:					
Chief and assistants	$2,419 00		$102 60	$4 10	$2,525 70
Traveling			1,047 91		1,047 91
Rent			69 00		69 00
Total fish rescue	$2,419 00		$1,219 51	$4 10	$3,642 61
Game refuge:					
Chief and assistants	$1,999 98				$1,999 98
Clerical and office	900 00	$0 20	$1 25		901 45
Automobiles		293 98	262 82		556 80
Traveling			813 33		813 33
Lion hunters and trappers	3,540 12				3,540 12
Refuge posting	1,393 42	73 33			1,466 75
Game refuge supplies		40 58			40 58
Lion bounties			2,320 00		2,320 00
Total game refuge	$7,833 52	$408 09	$3,397 40		$11,639 01
License commissions			$23,868 60		23,868 60
Game refuges					3,928 08
Construction of Russian River jetties					17,750 00
Expenditures to pay claims for return of fish and game licenses					83 50
Expenditure to pay claim of Harry L. Hopper					658 50
Prior year					132,529 93
Grand total					$679,988 87

STATEMENT OF INCOME

For the Period July 1, 1929 to December 31, 1929 of the Eighty-first Fiscal Year

	Detail	Total
License sales:		
Angling, 1929	$329,783 95	
Hunting, 1929	298,030 87	
Market fishermen's licenses, 1929-1930	25,250 00	
Wholesale fish packers' and shell fish dealers', 1928-1929	20 00	
Game breeders' licenses, 1929	105 00	
Fish breeders' licenses, 1929	75 00	
Trapping licenses, 1929-1930	3,138 00	
Commercial hunting club, 1929-1930	2,565 00	
Commercial hunting club operators', 1929-1930	730 00	
Deer tag licenses, 1929	107,204 80	
Kelp licenses, 1929	10 00	
Fish importers' licenses, 1929	55 00	
Wholesale fish packers' and shell fish dealers' licenses, 1929-1930	1,065 00	
Angling licenses, 1930	89 00	
Hunting licenses, 1930	262 00	
Total license sales		$768,383 62
Other income:		
Game tag sales	$23 01	
Court fines	49,489 94	
Fish packers' tax	50,211 51	
Kelp tax	51 13	
Fish tag sales	1,755 54	
Miscellaneous sales	376 80	
Interest on bank balances	3,168 04	
Total other income		$105,075 97
Total departmental income		$873,459 59

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF OCTOBER, NOVEMBER AND DECEMBER, 1929

Compiled by Division of Fish and Game, Bureau of Commercial Fisheries

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Alameda, Contra Costa	San Francisco, San Mateo	Santa Cruz	Monterey
Albacore									
Anchovies							33,330		454
Barracuda									
Bonito								263	83
Carp				542	10,555	2,114	13,786		
Catfish		11,882		1,147	115,761	55,389			
Cultus Cod	24,755	72,175	272				148,018	13,389	46,129
Eels									
Flounders	687	7,922					40,202	16,648	96
Grayfish							119,182	8,225	
Hake							9,912	1,500	
Halibut	81,619	1,674					4,872	5,010	2,428
Hardhead					29,383				
Herring			99,030			1,900	92,829		
Kingfish							2,236	10,925	28,199
Mackerel							28,371	632	390,750
Mackerel—Horse									21,023
Mullet									
Perch	4,168		13,531				9,587	1,813	4,983
Pike				133	286	528			
Pompano									
Rock Bass									
Rockfish	21,523	27,572	55			258	441,806	123,795	375,035
Sablefish	136,211	3,598					134,216	138,593	14,265
Salmon	89,424			1,028	779	769			
Sandabs	225	7,450					132,319	13,145	3,676
Sardines							23,993,064	1,003	145,268,400
Sculpin	9	233							
Sea Bass—Black									
Sea Bass—White			13,035				11,699	10,993	342
Shad				2,566	1,384	3,165			
Shad—Buck					38				

Sheepshead									
Skates		390					46,808	1,950	826
Skipjack									
Smelt	9,151		5,990				14,572	15,774	17,510
Sole	20,225	39,910					3,147,749	67,123	7,716
Splittail					2,659				
Striped Bass			499	22,883	73,457	99,571			
Suckers					411	38			
Swordfish									
Tomcod							4,025	62	
Tuna—Bluefin									
Tuna—Yellowfin									
Turbot			68						
Whitebait	2,495	1,437	58				3,712		83
Whitefish									
Yellowtail									
Miscellaneous	1,707	1,615			89	36	3,946	134	2,006
Total fish	392,199	175,858	132,538	28,299	234,802	163,768	28,436,241	430,277	146,184,004
Crustaceans:									
Crabs	[1]10,152		[2]360				[3]592,104	[4]10,824	[5]24
Shrimps			268,380				175,225		
Spiny Lobsters									
Mulluska:									
Abalones									651,000
Clams—Cockle			11,518						
Clams—Mixed	3,435								
Clams—Pismo								48	3,455
Clams—softshell			13,571			6,933	4,120		
Cuttlefish		641					993	50	10,233
Mussels							15		100
Oysters—Eastern							[6]170,201		
Oysters—Native	720		203				2,642		
Squib									28,802
Miscellaneous:									
Turtles									
Totals	406,506	176,499	426,570	28,299	234,802	170,701	29,381,541	441,199	146,877,618

[1] 423 dozen.
[2] 15 dozen.
[3] 24,671 dozen.
[4] 773,645 shell oysters.
[5] 451 dozen.
[6] 1 dozen.

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF OCTOBER, NOVEMBER AND DECEMBER, 1929—Continued

Compiled by Division of Fish and Game, Bureau of Commercial Fisheries

Species of fish	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego, Imperial	Total	Fish from south of the International Boundary brought into San Pedro	Fish from south of the International Boundary brought into San Diego	Total fish from south of the International Boundary brought into California
Albacore		40,793	64		40,857		45	45
Anchovies					33,784			
Barracuda	604	234,142	345	18,147	253,238	419,926	118,647	538,573
Bonito	307	24,287	221	6,992	32,153	248,638	33,491	282,129
Carp					26,997			
Catfish					184,179			
Cultus Cod	117	2,220			307,075			
Eels		317			317			
Flounders	32	1,337			66,924		123	123
Grayfish	2,222	35,905	7,634	34,717	207,885			
Hake					11,412			
Halibut	79,608	64,204	1,293	13,250	253,958	531	49,191	49,722
Hardhead					29,383			
Herring	20			4,142	197,921			
Kingfish		86,726	20	1,876	129,982			
Mackerel	3,123	10,693,545	1,762,364	2,688,835	15,567,620		1,405	1,405
Mackerel—Horse		223,106	4,140		248,269	3,476		3,476
Mullet				803	803	1,959	3,783	5,742
Perch	5	21,296	151	96	55,630	464		464
Pike					947			
Pompano		108			108	1,226	125	1,351
Rock Bass	806	17,922	44,309	15,235	78,272	4,477	2,913	7,390
Rockfish	9,662	335,298	5,923	191,388	1,532,315		4,366	4,366
Sablefish		1,582	59		428,524			
Salmon					92,000			
Sandabs		3,559			160,374			
Sardines	5,315,130	109,867,749	606	1,163,735	285,609 687			
Sculpin		21,810	193	3,291	25,536			
Sea Bass—Black	33	14,714	7,508	27,625	49,880	22,137	55,919	78,056
Sea Bass—White	13,542	119,126	11,466	36,200	216,403	103,384	88,067	191,451
Shad					7,115			
Shad—Buck					38			

Sheepshead	5,121	69,702	2,266	14,417	91,506		223	223
Skates	1,498	2,982	34	295	54,083		234	234
Skipjack		2,811,869	36	622,699	3,434,604	2,739,594	6,342,323	9,081,917
Smelt	3,674	98,797	39,650	6,128	211,246			
Sole	34,448	15,863	30	171	3,333,235			
Splittail					2,659			
Striped Bass					196,410			
Suckers					449			
Swordfish		78,924	776	75,770	155,470		774	774
Tomcod					4,087			
Tuna—Bluefin		379,807			379,807			
Tuna—Yellowfin		92,735		208	92,943	2,630,116	10,148,490	12,778,606
Turbot					68			
Whitebait					7,785			
Whitefish	195	53,662	233	9,641	63,731		3,884	3,884
Yellowtail	17	19,420	1,346	70,932	91,715	317,057	291,074	608,131
Miscellaneous	69	17,624	372	202	27,800	88,224	63,886	152,110
Total fish	5,470,233	125,451,131	1,891,039	5,006,795	313,997,184	6,581,209	17,208,963	23,790,172
Crustaceans:								
Crabs					[1]613,464			
Shrimps					443,605			
Spiny Lobsters	35,798	166,036	19,940	91,940	313,714		257,603	257,603
Mollusks:								
Abalones	5,057				656,057			
Clams—Cockle		7,289			18,807			
Clams—Mixed				85	3,520			
Clams—Pismo	17,155				20,658			
Clams—Softshell					24,624			
Cuttlefish		7	253		12,177			
Mussels					115			
Oysters—Eastern					[2]170,201			
Oysters—Native					3,565			
Squid					28,802			
Miscellaneous:								
Turtles				58	58			
Totals	5,528,243	125,624,463	1,911,232	5,098,878	316,306,551	6,581,209	17,466,566	24,047,775

[1] 25,561 dozen.
[2] 773,645 shell oysters.

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Captains indicated in capitals.

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SACRAMENTO, 1930